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Moody Street and Colonial Avenue

DEPARTMENT
OF
LOWELL EVENING TEXTILE SCHOOL

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LOWELL EVENING TEXTILE SCHOOL.

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1933.

September 28, Thursday	Registration.
October 5, Thursday	Registration
October 9, Monday	Opening of evening school.
November 30, Thursday / December 1, Friday	Thanksgiving recess. No classes.
December 22, Friday	End of first term.

1934.

January 4, Thursday	Opening of second term.
March 9, Friday	Closing of evening school.
April 10, Tuesday	Graduation.

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Evening Instructor in Freehand Drawing.

EVENING CLASSES

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the second Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

Every student who takes the chemistry and dyeing course must check up his desk with the instructor of that department when he leaves the school. Any student not doing so will be charged 50 cents.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

110. Cotton Yarns—3 Years.

The *first year* work in cotton yarn manufacture consists of a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used and the production of each process as well as the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the control of waste.

Two evenings per week.

Cotton.—Before taking up the details of manufacturing cotton into yarn, a careful study of its physical characteristics is made. The geographical distribution of the areas producing commercial cottons is explained and the characteristics of the cottons produced in each are studied. A general explanation of the cultivation and harvesting of cotton is made, especially emphasizing the effect of agricultural factors on the cotton fiber and how these may serve to complicate manufacturing problems.

The ginning of cotton is considered, showing the yield of lint, the uses of cotton seed and the various types of gins and which cottons are commonly ginned on each.

The intricate system of buying and selling cotton is studied to illustrate the problems a mill may meet in procuring cotton. In this connection, special emphasis is placed on the classification of cottons by staple and by grade.

Opening and Picking.—Instruction in the preliminary operation of opening and picking covers the mechanical construction of the machines, their parts and adjustments, as fully as the manufacturing results accomplished by the machines. This includes such construction details as evener, lap measuring and safety stop motions, grids, cleaning trunks and beaters, also operation details which involve the adjustment for waste, drafts and character of laps. Some time is devoted to mixing in its various phases, showing in addition to improvement in uniformity of the product, how cottons are mixed to obtain definite average prices and how different percentages of color may be obtained by mixing, expecially on the pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calcu-

lation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work includes a study of the drawing and roving processes and the calculations that accompany these operations. It consists of lectures on the machines and demonstration of their adjustment, showing roll setting, draft and twist control, builder adjustment, spacing coils on the bobbin, and tension control.

One evening per week.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, clearers and evener motions.

Roving Process.—Under this head are studied the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use.

During the *third year* the time is devoted to a study of ring and mule spinning, spooling, winding, twisting and reeling, instruction being given by means of lectures and demonstrations. There is also some work done on the combing machine, particularly in the nature of its adjustment. In addition to these subjects, some time is spent on planning the organization of a cotton mill with a view to showing drafts, speeds, productions and number of machines of each kind necessary for the production of a given amount of a certain yarn.

Two evenings per week.

Ring Spinning.—The consideration of spinning yarn by the ring frame method involves a knowledge of the uses to which the yarn is to be put and subsequent methods of handling, that proper roving may be selected, suitable amounts of draft and twist provided, correct size of rings and travelers selected, and building motions suitably adjusted. Yarn defects are studied with reference to the cause and remedy, necessitating references to many of the earlier operations.

Mule Spinning.—This method of spinning is very different from that of the ring frame, and the mechanical details are more complicated. The student is furnished with a new means of producing yarns, and can compare the relative advantages of each method. A thorough understanding of mule spinning is perhaps more a study of mechanical motions and their functions. This results almost invariably in assisting the student to understand previous processes and machines better because of his work on the mule. It is the object to make clear to the student's mind the principles underlying the construction and operation of the parts that control the drawing, twisting, backing off and winding, together with such special motions and devices as are used upon the modern mule.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, ring or mule spun, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of

numerous fancy yarns and the principles underlying the production of unlimited patterns is taken up here. The use of special twisters and other apparatus for cords and ropes is considered at this point.

WOOLEN AND WORSTED DEPARTMENT.

210. Worsted Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc., also a course in carding and the calculations involved in the mechanism of the machines, and a course covering gilling and combing and the processes of top making.

Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk, mohair, alpaca, vicuna, cashmere, camel's hair and cotton. In connection with these are considered shoddy, noils and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture. The various characteristics and properties are explained, as are also trade terms, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of soaps and chemicals used in washing; also the waste products and their utilization. A demonstration of a commercial quantity of wool is scoured by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap. At the same time the use of driers, their operation and regulation, is taken up, and the methods of carbonizing wool, noils, burr waste, rags, etc., are studied and explained.

Carding.—The different systems of carding wool, depending on whether it is to be made into woolen or worsted yarns, are fully explained, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application and grinding.

Top Making and Combing.—This branch takes up, besides the carding of the wool on a worsted card, the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures. Later, quantities of stock are made into top and then into yarn.

Three evenings per week.

The *second year* is devoted to detail study of the English and French systems of worsted yarn manufacture.

The Noble, Lister and French combs are studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings per week.

211. Woolen Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc., also of a course on carding, and the calculations involved in the mechanism of the machines.

Two evenings per week.

The *second year* continues the instruction on carding and then takes up a course on the mule and woolen yarn spinning.

Burr Picking, Mixing, Oils and Emulsions.—The use of burr pickers in cleaning wool and the use of mixing pickers in making color blends is covered by lecture and demonstration. Under the subject of oils and emulsions are taken up the characteristics of various oils and the means employed to test them.

Woolen Mule.—The student studies thoroughly the operation of the mule as a whole, and acquaints himself with the various principal mechanisms, as, for example, the backing off and winding motions, the quadrant, builder-rail, faller regulation, etc.

Two evenings per week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for any type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings per week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings per week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings per week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured

and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings per week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings per week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings per week.

314. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

One evening per week.

315. Woolen and Worsted Weaving—2 Years.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

One evening per week.

316. Dobby and Jacquard Weaving—1 Year.

This course considers the various types of Jacquard heads and dobbies, which includes single cross border dobbies and leno attachments on double lift dobbies, handkerchief motions, leno weaving, center selvedge motions, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving. The course on Jacquard looms includes general construction, card cutting, lacing, repeating and fixing.

One evening per week.

317. Freehand Drawing—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings per week.

During the second year instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings per week.

In the third year the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Pen and ink, pastels, and water colors can be added when time will permit.

Two evenings per week.

318. Show Card Design—2 Years.

During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings per week.

The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings per week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings per week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings per week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.
Laboratory Work in Dyeing.
Covered by 60 lectures and two nights of laboratory work per week.
The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights per week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Talbot's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, cloth and other materials of particular interest to the textile chemist, special lecture notes and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings per week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

For one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint, the course in Mechanical Drawing is offered. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

This course is a complete course in drawing and requires *two evenings per week* for three years for its completion. The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete. The time required is *two evenings per week.*

619. Mechanics and Mechanism—2 Years.

This is one of the most important of engineering subjects dealing as it does with the principles which underlie the transmission of force and motion through machines and mechanical devices. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion and the course concludes with a study of pulleys, belting, gears and gearing, as far as time permits. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires attendance *two evenings per week* with home problem work and the study of a text book.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further by evening study the mathematics of his grammar or junior high school course. It includes algebra, elementary trigonometry, logarithms and slide rule, and requires attendance for *two evenings per week.* It should be taken by all who intend to study further into engineering subjects. Instruction is largely through problem work in class and at home, and the use of a text book.

Some of the topics treated are—

Elementary algebraic operations of—

- Addition.
- Subtraction.
- Multiplication.
- Division.
- Factoring.
- Fractions.
- Graphical representation.
- Linear equations.
- Radicals.
- Quadratic equations.
- Logarithms.
- Slide rule.
- Trigonometry.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The time required is *two evenings per week* and the method of instruction is through lectures, recitations, problems, and the use of a text book.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used, requiring an attendance of *two evenings per week.*

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. It requires for its completion attendance for *two evenings per week* and a considerable amount of home study and preparation. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work. An attendance of *two evenings per week* is required.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated.

A test book is required and the class is held *two evenings per week.*

626. Mill Illumination—1 Year.

Because of the demand by mill men, this course is now offered to evening students and requires an attendance of *two evenings per week.*

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

627. Textile Marketing—1 Year.

An elementary course designed to acquaint the student with the principles of selling and merchandising of textiles.

The selling agent, broker, converter, wholesaler, merchant, factor, and other

intermediaries in the channels of distribution are studied as well as the fundamentals of salesmanship, advertising, styling, market research, pricing, retailing, wholesaling, and forecasting.

The material is presented by means of lectures and class discussions on assigned problems. An attendance of *two evenings per week* is required.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In these courses machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. These courses also help the finisher to broaden his knowledge of textile fabrics. Attendance is required for *two evenings per week*.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due

to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings per week.

711. Cotton Finishing—1 Year.

The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the objects thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types, and for various purposes; the use of cooling tanks, steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing; the use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustment of various types.

Water Mangles.—Their object and construction of various types; various rolls,—iron, husk, etc., scutchers, their object and construction.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls,—brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical, tenter frames, clips; the swing motion and the finishes thus produced; construction; spraying machines, belt stretchers, button breakers; their object and construction.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk and paper; the use of hot and cold rolls; chasing, friction, embossing and Shriner calenders and the various finishes produced by each; production of watered effects; beetling machines.

Making up room,—yarding, inspecting; different types of folds; pressing, papering, marking.

Two evenings per week.

EVENING GRADUATES OF 1933.

Certificates awarded as follows, April 4, 1933:

Cotton Yarns—3 Years.

Lionel Theophile Pelletier	Lowell
John Henry Shaw	Methuen

Woolen Manufacturing—4 Years

Richard Waterhouse	Maynard

Woolen Yarns—2 Years.

Clarence Richard Smith	Andover
Stanley Edward Wojas	Lowell

Worsted Yarns—2 Years.

Gordon Denby Ambler	Chelmsford
Anthony Domenico Borrelli	Lawrence
James Bernard Cousen	Lawrence
Walter Dzioba	Lawrence
Joseph Woodrow Kenyon	Lowell
Harry Augustine Matthes, Jr.	Lawrence
Irvine Walter Merrill	Lawrence
George Chadwick Richards, Jr.	Andover
Herbert Hodgson Robinson	Methuen

Cotton Design—3 Years.

Olen Franklin Marks	Lowell
Edward William Tamulonis	Lowell

Woolen and Worsted Design—3 Years.

Abbot Gaunt	Methuen
Ralph Irving Littlefield	Lowell
George Sumner Orr	Methuen
Ernest Dobson Robinson	Methuen

Show Card Design—2 Years.

Leo Fernand Cote	Lowell
Joseph Henry Harne	Lowell
Maurice Ismael Lareau	Lowell
Francis Ernest Matte	Lowell
Stanley Joseph Michalik	Lowell
Eugene Lawrence O'Connor	Lowell
Japhet Eustache Prud'homme	Lowell
Doris Lavinia Rigby	Lowell

Freehand Drawing—3 Years.

Albert Joseph Beauregard	Lowell
Hildred Lenore Benway	Lowell
Mary Bertha Desilets	Lowell
Simonne Jeannette Drouin	Lowell
Helena Joan Fish	Lowell
Stella Magiera	Lowell
Gladys Gertrude Mooney	Lowell
Mary Ann Morin	Lowell
Jeannette Alma Pelletier	Lowell
Mary Catherine Savage	Lowell
Ivy Mae Smith	Lawrence
Kazimierz John Stys	Lowell
Mary Elizabeth Sullivan	Lowell
Nancy Agnes Turnbull	Lowell
Lorraine Estelle Vigeant	Lowell
Adam Carol Zabierek	Chelmsford

Cotton Weaving—1 Year.

Samuel Baguley	Lowell
Joseph Frederic Burtt	Lowell
John Ainsleigh Gallagher	Lowell
Marguerite Therese Richards	Lowell
Stanley Edward Wojas	Lowell

Dobby and Jacquard Weaving—1 Year.

Joseph Frederic Burtt	Lowell
John Ainsleigh Gallagher	Lowell
John Jana	Lowell
Olen Franklin Marks	Lowell
Francis Adrien Soulard	Lowell
Joseph Anthony Stewart	Lowell
Percy Lorenzo Willis	Lowell

Woolen and Worsted Weaving—2 Years.

Chester Arthur Brown	Lowell
Alfred Omer Chouinard	Lowell
John Ainsleigh Gallagher	Lowell
Otto Karl Hemmerling	Lawrence
Harold Addison Robey	Lowell

Woolen and Worsted Finishing—1 Year.

George Frederick Cohen	Lawrence
Edward Elphege Gagne	Lawrence
George Frederick Hemas	Lawrence
Burton Herman Locke	Chelmsford
Harold Norman Logan	Lowell
William Herbert Midgley	Andover
Otto Frank Minzner	Methuen
Joseph Chanel Ricard	Lawrence
Eugene Paul Schremp	Lawrence
Claude Alfred Taylor	Methuen

Elementary Chemistry—2 Years

Pauline Allen	Lawrence
Benjamin Ambler	Chelmsford
Lionel Arsene Boisvert	Lawrence
Guido Joseph Cianci	Lawrence
Raymond Conrad Desmarais	Haverhill

Edgar Fortin	Lawrence
Edward Louis Gaudreau	Lawrence
Albert Francis Haley	Haverhill
Elbert Arthur Haley	Tyngsboro
Harry Fraser Holmes	Ipswich
Edward George Maguire	Bradford
Herbert Neild	Lowell
Hervé Armand Paquin	Lowell
Edward James Quigley	Lowell
Thomas Wilkinson Shoesmith	Lawrence
Myra Spencer Stone	Lawrence
Brendon Vincent Tully	Lowell

Textile Chemistry and Dyeing—3 Years.

Walter Samuel Bean, Jr.	Lowell
Richard Warwick Bower	Methuen
William Edward Coulton	Lawrence
Arthur Francis Kittredge, Jr.	Melrose
John James Murphy	Medford
Raymond James Schuster	Lawrence

Analytical Chemistry—3 Years.

Arthur William Lemkin	Lowell
James Angus McGillivray	Lowell

Textile and Analytical Chemistry—4 Years.

Sumner Edmunde Shepard	Methuen

Mathematics—2 Years.

Leslie Nelmes Athorn	Forge Village
Joseph Gideon Chouinard	Lowell
James Stuart Clarke, Jr.	Lawrence
Helen Julia Daly	Lowell
John Lahiff Dolan	Lowell
Thomas Joseph Fitzsimmons	Lowell
Joseph Benedict Gallagher	Lowell
Philip Joseph Garrigan, Jr.	Lowell
Paul Joseph Heron	Lowell
Thomas Pasquill Houldsworth	Methuen
John Joseph Kenney	Lowell
Uriel William Lemkin	Lowell
Arthur Long	Methuen
John Erwin Martin	Lowell
Dolor Nelson Joseph Morel	Lowell
Ella Josephine Mulligan	Lowell
Alfred Robinson	Methuen
Leo James Sheehan	Dracut
William Francis Smith	Lowell
Lincoln Scott Staveley	Lowell
Fred Symons	Methuen
Walter Henry Wood	Lowell

Direct Current Electricity—2 Years.

Joseph Leo Champagne	Lowell
Edward John Dunn	Lowell
Charles Adolph Ermer	North Salem, N.H.
Carl Benjamin Laidlaw	Lowell
Arne John Mikkola	Lowell
Ralph Bailey Newton	Lowell

Guy Michael Palermo	Salem, N. H.
Errol Hawthorne Silk	Lowell
Joseph Lawrence Wade	Lawrence

Alternating Current Electricity—2 Years.

Ejner Guthil Blomquist	Andover
John Milton Cole	Methuen
Gerald William Gross	Tewksbury
Clifford Hartley	Lowell
Henry Homer Martell	Lowell
Alberto Max Ransden	Tewksbury

Mechanical Drawing—3 Years

Lincoln Scott Staveley	Lowell
Ralph Emmons Tweed	Lowell

Machine Shop Practice—2 Years.

Armand Louis Gagnon	Lowell
Leo Anthony Gaudet	Andover
Merle George James	North Billerica

Textile Marketing—1 Year

Joseph Allen, Jr.	Lawrence
Raymond William Berry	Lowell
John Kenrick Butler	Lowell
Joseph John Devine	Lowell
Reginald Edward McEachern	Lowell
Allan Daniel McQuarrie	Lowell
Joseph Patrick Moynihan	Lowell
John Patrick Murphy	Lowell
Thomas Rennie Palmer	Methuen
Leo Donat Vigneault	Lowell

Power Plant Machinery—1 Year.

Daniel Francis Callahan, Jr.	Lowell
Hugh Longstaff Christison	Methuen
Florand Joseph Gauthier	Lowell
Desmond Alexander McElholm	Lowell
Edward Joseph Stepinski	Graniteville
Jack Thornton	Lowell

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2200. 12-'33. Order 9912.

THE EFFECT OF REMOVAL OF NOIL ON YARN CHARACTERISTICS

The data, on which this bulletin is based, were taken from a study carried on in the Department of Cotton Yarns by Mr. W. Edwin Stevens, a senior student. The subject was selected at the suggestion of an alumnus, who is interested in producing the best yarn possible without increasing the cost out of proportion to the increase in quality.

The purpose of this study was to compare the characteristics of yarns spun from the same raw stock, when different percentages of noil were removed in combing.

The cotton used was of Good Middling grade having a staple of 1 3/16 inches. The entire quantity was treated as one lot until it reached the sliver lapper. A portion was then set aside to make carded yarns. At the comb, the remaining cotton was divided into five lots. From drawing on, each lot was treated the same, all the lots being run at the same time on each machine and marked with different chalk to distinguish one lot from another lot. Carding and the following operations were carried on in a room automatically controlled at 53% relative humidity.

The organization used is tabulated below:

Card	50 grs.
Sliver Lapper	650 "
Ribbon Lapper	650 "
Comb	60 "
Drawing	60 "
Slubber	.65 Hk.
Intermediate	1.80 Hk.
Fine	5.50 "
Spinning	28.00's

At the comb each lot had a different percentage of noil removed as follows:

Lot	1	2	3	4	5	6
Noil	(Carded)	13.7	15.8	18.0	20.4	24.7

The yarns spun from the six lots of cotton were conditioned in a standard atmosphere and tested for size and skein strength. Samples from each lot were wound on black boards and photographs were taken of representative samples. A plot was made showing the relation between the average strength for each lot and the percentage of noil removed.

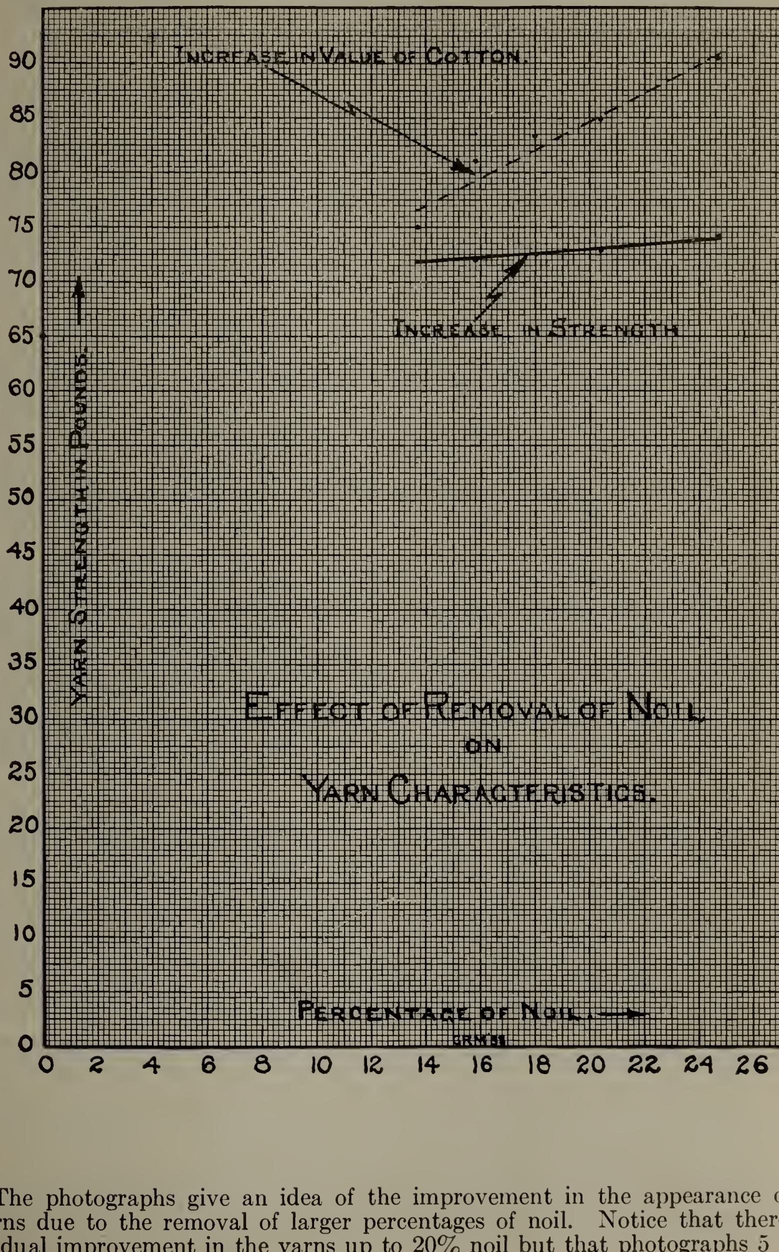
A summary of the data obtained is added here.

Lot	1	2	3	4	5	6
Per cent noil	0	13.7	15.8	18.0	20.4	24.7
$\left(\frac{1}{100 - \%\ \text{noil}}\right) \times 68.25$	—	75.0	81.1	83.3	84.9	90.5
Counts (Spun)	28.8	29.4	28.4	28.1	26.7	28.2
Strength	63.2	68.3	71.3	72.3	75.3	73.8
Constant	1820	2010	2015	2030	2035	2075
Strengths (28's)	65.0	71.8	72.0	72.5	72.7	74.1

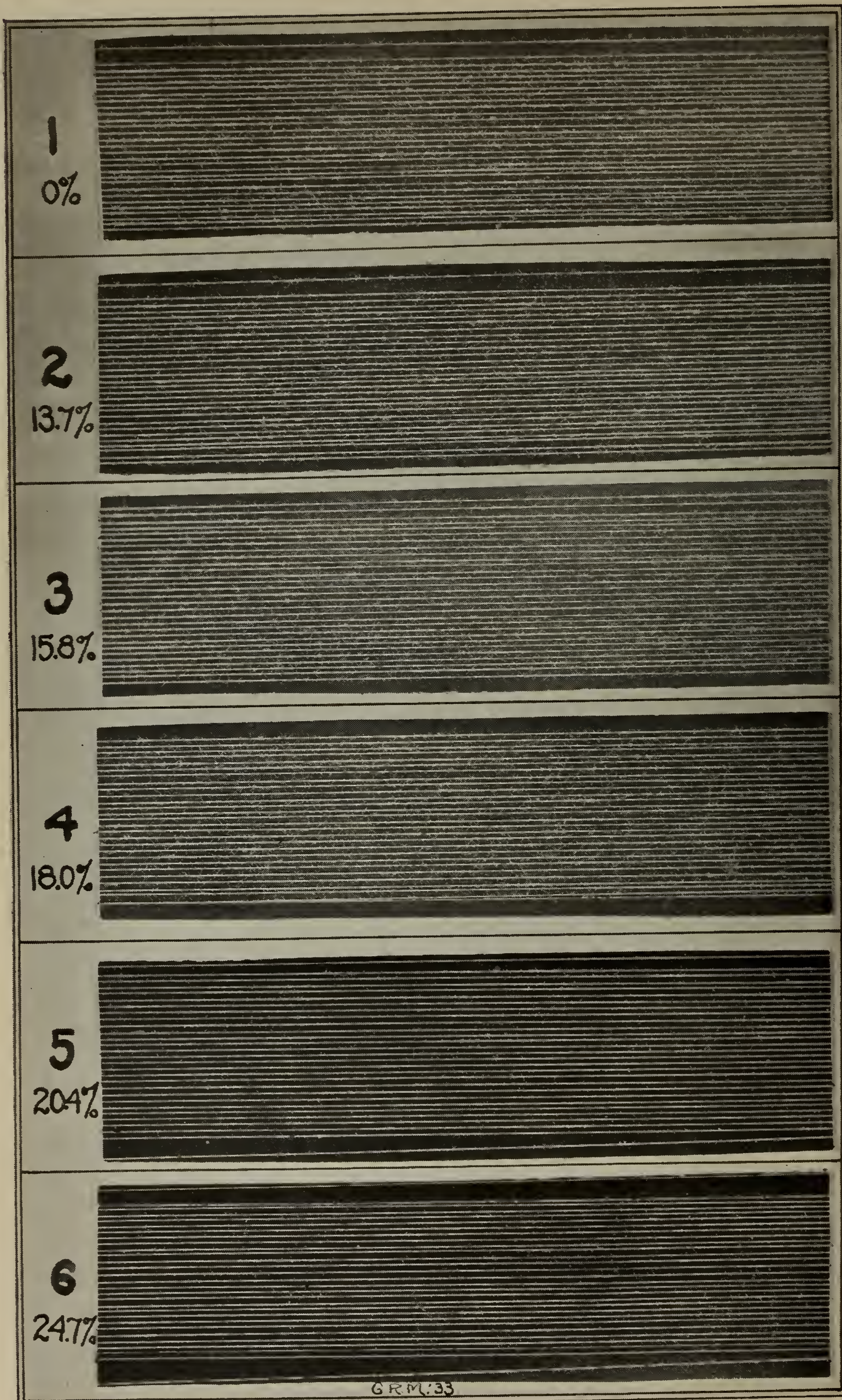
The accompanying plot shows the strength figures converted to the equivalent strength for a 28's yarn plotted against the percentage of noil removed. Note that there is a gradual increase in strength as more noil is removed.

The dotted line in this plot represents the inverse of (100 — percentage of noil) multiplied by a constant (68.25) to make the value plot on about the same scale as the strength figures. This dotted line serves to give an approximate idea of the

increased value of the cotton in the combed sliver due to the removal of waste. It serves to indicate that the cost of the cotton in the sliver increases at fully as rapid a rate as the rate of increase in strength.



The photographs give an idea of the improvement in the appearance of the yarns due to the removal of larger percentages of noil. Notice that there is a gradual improvement in the yarns up to 20% noil but that photographs 5 and 6 show very little difference.


1
0%
2
13.7%
3
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Southwick Hall

SERIES 37. NO. 3. February, 1934

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1934

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CALENDAR

1933–1934

September 14–15, Thursday–Friday	Entrance Examinations
September 18–23, Monday–Saturday	Re-examinations
September 21, Thursday, 9.00 A.M.	Registration for Freshmen
September 25, Monday	Registration for upper-class students Classes begin for Freshmen
September 26, Tuesday	Classes begin for upper-class students
October 12, Thursday	Columbus Day — Holiday
November 28, Tuesday, 4.45 P.M.	Thanksgiving recess begins
December 4, Monday, 9.00 A.M.	Thanksgiving recess ends
December 22, Friday, 4.45 P.M.	Christmas recess begins
January 3, Wednesday, 9.00 A.M.	Christmas recess ends
January 15, Monday	First term examinations begin
January 26, Friday	End of first term
January 29, Monday	Second term begins
February 22, Thursday	Washington's Birthday — Holiday
March 23, Friday, 4.45 P.M.	Spring recess begins
April 2, Monday, 9.00 A.M.	Spring recess ends
April 19, Thursday	Patriots' Day — Holiday
May 21, Monday	Second-term examinations begin
May 30, Wednesday	Memorial Day — Holiday
June 5, Tuesday	Commencement
June 7–8, Thursday–Friday	Entrance Examinations

1934–1935

September 13–14, Thursday–Friday	Entrance Examinations
September 17–22, Monday–Saturday	Re-examinations
September 20, Thursday, 9.00 A.M.	Registration for Freshmen
September 24, Monday	Registration for upper-class students Classes begin for Freshmen
September 25, Tuesday	Classes begin for upper-class students
October 12, Friday	Columbus Day — Holiday
November 12, Monday	Holiday — Observance of Armistice Day
November 27, Tuesday, 4.45 P.M.	Thanksgiving recess begins
December 3, Monday, 9.00 A.M.	Thanksgiving recess ends
December 21, Friday, 4.45 P.M.	Christmas recess begins
January 2, Wednesday, 9.00 A.M.	Christmas recess ends
January 14, Monday	First term examinations begin
January 25, Friday	End of first term
January 28, Monday	Second term begins
February 22, Friday	Washington's Birthday — Holiday
April 12, Friday, 4.45 P.M.	Spring recess begins
April 22, Monday, 9.00 A.M.	Spring recess ends
May 20, Monday	Second term examinations begin
May 30, Thursday	Memorial Day — Holiday
June 4, Tuesday	Commencement
June 6–7, Thursday–Friday	Entrance Examinations

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HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commission of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because

of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had in charge the work of construction. The building completes the fourth side of the quadrangle, and in outward appearance corresponds to the architectural features of the other school buildings. It is a single-story building, and has the dimensions of 195 by 60 feet. Its interior is faced with cement brick made at the school during the progress of the work. These serve to give light-reflecting walls which are advantageous for the work of the Wool Manufacturing, Cotton Finishing and Chemistry and Dyeing

Departments that occupy this building. The funds for this building were provided by the State of Massachusetts.

The buildings are of modern mill construction adapted to educational uses and contain approximately 180,563 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus. Chest weights, wooden dumb-bells, Indian clubs, a set of traveling rings, a vaulting horse, parallel bars, a punching bag and several sets of foils and single sticks have been provided.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	11

Elective Subjects	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make ten points and present certificates showing satisfactory courses in such of the elective subjects to make three additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of twelve points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	9

Elective Subjects

Three may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 7, 1934; Thursday, September 13, 1934; Thursday, June 6, 1935:—
Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 8, 1934; Friday, September 14, 1934; Friday, June 7, 1935:—
Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

GRADUATE COURSES

Graduates of technical courses of other schools are invited to communicate with the president with reference to special courses in the textile studies. Previous training in the sciences and the engineering branches will usually reduce materially the time necessary to complete any of the courses at the Institute. The advantages offered to such persons for special research work are unexcelled, and a most profitable course may be arranged.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be succcessul in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 20, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction from the mark obtained in the course in which the absences occurred will be made.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians of all students under age, and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—For all first-year students a minimum deposit of $25 is required to cover the cost of breakage, supplies, apparatus and chemicals used in the Chemical Laboratory, the unexpended balance to be returned to the student at the end of the year. For all students in second, third, and fourth years taking work in Chemistry and Dyeing Laboratories a deposit of $25 for the first term and $25 for the second term is required.

Students taking Machine Shop will be required to make deposit of $15 to cover cost of materials, supplies and breakage. Included in this charge is a kit of tools which is essential to the work and which becomes the personal property of the student. The unexpended balance will be returned at the end of the year.

Students not taking Chemistry Laboratory or Machine Shop will be required to make a deposit of $10 each year to cover general breakage. The unexpended balance will be returned at the end of the year.

All deposits must be made before students can be admitted for laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if

mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers are provided for the use of the students, sufficiently capacious to contain clothing, books and tools.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	15
General breakage fee (This applies to students who do not take chemistry or machine shop.)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50

SCHOLARSHIPS AND PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives annually a theatrical program at the Lowell Auditorium. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—A Student Section of the American Society of Mechanical Engineers holds meetings regularly in accordance with requirements of the national organization. The Student Section of the American Society of Dyers and Colorists holds meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Co-operative Society.—This society is maintained for the benefit of students who desire to purchase supplies and materials for use in connection with their work. It is operated under the direction of a manager and assistant manager and one or more clerks. The general business policy is under the supervision of a member of the faculty. Students who join the society are entitled to discount privileges when purchasing from the society and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1933–34

Walker F. Prescott, '09, *President*
Chester C. Pease, '09, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Ex–Officio Members of Executive Committee

Edward M. Abbot, '04
Henry A. Bodwell, '00
Charles W. Churchill, '06
Thomas T. Clark, '10
Frank L. McCool, '10
Stanley H. Wheelock, '05
Royal P. White, '04

Executive Committee
15 *Members*

Roy H. Bradford, '06
Alexander Campbell, '23
Earl W. Clark, '18
James F. Dewey, '04
Russell T. Fisher, '14
Olin D. Gay, '08
Frederic S. Gilley, '16
Arnold J. Midwood, '05
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Dean W. Symmes, '22
Philip H. Warren, '05
J. Milton Washburn, '21
A. Edwin Wells, '20

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term

(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	120
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	90

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	120	Textile Design and Cloth Analysis D–10	90
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	255	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

FIRST YEAR. SECOND TERM. (HOURS OF EXERCISE)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	120	Textile Design and Cloth Analysis D–10	90
Mathematics B–10	60		
Mechanism B–12	60		

SECOND YEAR. FIRST TERM

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

SECOND YEAR. SECOND TERM

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C–20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

THIRD YEAR. FIRST TERM

Electricity B–31a	30	Textile Testing G–31	30
Mill Engineering B–34a	30	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135	Worsted Yarn Manufacture G–30	225

THIRD YEAR. SECOND TERM

Knitting F–31	120	Worsted Yarn Manufacture G–30	210
Power Weaving D–32	120	Thesis.	
Woolen and Worsted Finishing H–30	75		

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	120	Textile Design and Cloth Analysis D–10	90
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20a	90	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20, 21	240
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	75	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20–21	90	Textile Design and Cloth Construction D–20, 21	135
Jacquard Design D–23	45		
Physics B–23a	45		
Power Weaving D–24	105		

Third Year. First Term

Cotton Finishing H–31	75	Textile Testing G–31	30
Cotton Yarn Manufacture F–30a	60	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	60	Worsted Yarn Manufacture G–30	90
Textile Design and Cloth Construction D–30	135		

Third Year. Second Term

Cotton Finishing H–31	75	Woolen and Worsted Finishing H–30	75
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	60
Jacquard Design D–31	75	Thesis.	
Power Weaving D–32	105		
Textile Design and Cloth Construction D–30	75		

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultramicroscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several optional subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Adv. Organic Chemistry C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–23	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Adv. Organic Chemistry C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15	Economics E–30	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
		Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	75	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Photography C–37	15
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
Organic Laboratory C–36	90	Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	90	Options or Thesis C–52	90
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Organic Laboratory C–41	90
Chemical Textile Testing C–43	45	Quantitative Analysis C–46	15
Industrial Chemistry C–42	30	Report Writing C–47	15
Microscopy and Photomicroscopy C–45	60	Technical German C–40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Options or Thesis C–52	90
Adv. Textile Chemistry and Dyeing Lab. C–44	90	Organic Laboratory C–41	105
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Rayon Manufacturing C–51	30
Chemical Textile Testing C–43	45	Technical German C–40	30
Engineering Chemistry C–50	45	Technology of Wool and Allied Fibers G–40	15
		Textile Literature C–48	15

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The student is first thoroughly grounded in those fundamental principles of science upon which all industrial and engineering work rests. The foundation of his textile and technical training is in the subjects of mathematics, physics, chemistry, drawing, mechanics, mechanism, and technology of fibers, and their practical application.

Instruction is given in all the various branches of textile manufacturing through lectures, recitations and laboratory work. A large proportion of his time is spent in well-equipped textile departments where he studies and operates all of the machinery required in the conversion of cotton and wool fiber into yarns and fabrics. This includes cotton, wool and worsted yarn manufacturing, designing, weaving, knitting, dyeing and finishing. In his last year the course in textile testing acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering.

Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice.

Mill engineering familiarizes the student with mill design, construction, heating, lighting, humidification and fire protection. The arrangement of machinery and buildings for most efficient production and economical power distribution is also studied in detail.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

For the student who may desire the breadth of technical training which this course offers, but who wishes to specialize in either cotton or wool manufacturing, two options are offered. In these optional courses the student's entire textile time is devoted to the study of that particular fiber which he elects. Provision is also made for the substitution of knitting for weaving laboratory time in the case of those who prefer to lay more emphasis on knit fabrics.

During the past few years a demand has come from the distributing or marketing branches of the textile business for men with a four years' technical training. With the idea of offering courses which may better prepare graduates to meet this new call, the new Sales Option Course is offered.

There are also requests for a four-year Design Course which, while majoring in Textile Design, includes other subjects that help to make a broader course than the one of three years' duration. For this purpose the Design Option Course is offered. Like the other courses outlined, these will be subject to changes to meet new demands.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	120
Machine Drawing B–21	60
Machine Shop B–26	75
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–20	30
Textile Design and Cloth Construction D–22	45

Second Year. Second Term

Applied Mechanics B–25	45
Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Machine Drawing B–21	90
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	75
Textile Chemistry and Dyeing Lect. C–20	30

Third Year. First Term

Applied Mechanics B–30	45
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–32	75
Power Weaving D–32	60
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–33	90
Mill Engineering B–34	90
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	90
Cotton Organization F–32	90
Electrical Engineering B–44	75
Microscopy B–41	45
Mill Engineering B–45	75
Textile Marketing B–42	30
Textile Testing B–43	45
Thesis	75

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Electives B–48	
Electrical Engineering B–44	75
Knitting F–31a	30
Mill Engineering B–45	75
Mill Illumination B–47	45
Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	225	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–20	30
Machine Shop B–26	45		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Cotton Yarn Manufacture F–20a	165	Power Weaving D–24	105
Machine Drawing B–21	45	Textile Chemistry and Dyeing Lect. C–20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Finishing H–31	75	Power Weaving D–32	45
Cotton Yarn Manufacture F–30a	120	Textile Design and Cloth Construction D–20	45
Economics E–30	45		
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	150	Mill Engineering B–34	90
Economics E–30	45	Textile Design and Cloth Construction D–20	75
Electrical Engineering B–31	75		
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Textile Design and Cloth Construction D–30	30
Cotton Organization F–32	105	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Testing B–43	45
Microscopy B–41	45	Thesis	75
Mill Engineering B–45	30		

Fourth Year. Second Term

Business Administration B–46	90	Mill Engineering B–45	30
Cotton Finishing H–31	75	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105
Knitting F–31a	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–20	30
Machine Shop B–26	45		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	165	Power Weaving D–24	105
Machine Drawing B–21	45	Textile Chemistry and Dyeing Lect. C–20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Design and Cloth Construction D–21	75
Electrical Engineering B–44	75	Textile Marketing B–42	30
Microscopy B–41	45	Textile Testing B–43	45
Mill Engineering B–45	30	Thesis	135

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31a	30	Thesis	195
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20,21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		
Textile Design and Cloth Construction D–30	135		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Textile Physics B–37	45
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Power Weaving D–32	135	Woolen and Worsted Finishing H–30	75
Textile Design and Cloth Construction D–30	75		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Microscopy B-41	45	Textile Testing B–43	45
Textile Design and Cloth Construction D–41	120	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Textile Design and Cloth Construction D–41	120
Cotton Finishing H–31	105	Thesis	90
Jacquard Design and Weaving D-40	120		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Cotton Yarn Manufacture F–30a	60	Textile Design and Cloth Construction D–30	135
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Power Weaving D–32	75	Woolen and Worsted Finishing H–30	75
Principles of Marketing B–35	45		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Textile Physics B–37	45
Marketing Methods B–36	60	Worsted Yarn Manufacture G–30	90
Power Weaving D–32	30	Woolen and Worsted Finishing H–30	75
Statistics	45		

Fourth Year. First Term

Accounting B–40	90	Textile Design and Cloth Construction D–41	45
Jacquard Design and Weaving D-40	45	Textile Styling B–50	30
Microscopy B–41	45	Textile Testing B–43	45
Principles of Selling and Advertising B–49	105	Thesis	75
Selling Policies B–52	45		

Fourth Year. Second Term

Business Administration B–46	90	Jacquard Design and Weaving D-40	45
Cotton Finishing H–31	105	Knitting F–31a	75
Foreign Trade and Economic Geography B–51	45	Selling Policies B–52	45
		Thesis	120

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B–10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B–11. Preparation: Admission Requirements. Taken simultaneously with B–10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B–12. Preparation: B–10 and B–11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

Mechanical Drawing—B–13. Preparation: Admission Requirements. Taken simultaneously with B–11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized. This course is systematically laid out covering in order the following divisions:—

Care and use of drawing instruments; geometrical constructions; lettering; elements of projections and descriptive geometry; isometric projection; developments with practical applications; sketching practice on machine details; working drawings; tracing and blueprinting. [Courses I, II, III, VI.]

Machine Drawing—B–13a. Preparation: Admission Requirements. Taken simultaneously with B–11. This course is similar to B–13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B–20. Preparation: B–10. This subject is a continuation of the first year subject B–10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B–20a. Preparation: B–10. This subject is a continuation of the work of the first year subject B–10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B–21. Preparation: B–10, B–12, B–14. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B–23. Preparation: B–10 and B–11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, the vernier, wave motion and sound.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—nature and propagation of light, reflection and refraction lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B–23a. Preparation: B–10 and B–11. This subject consists of the same topics as B–23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B–24. Preparation: B–12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B–25. Preparation: B–11, B–20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B–26. Preparation: B–11 and B–12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as possible to commercial machine-shop practice on textile machinery. The list of

tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B–30. Preparation: B–25. This is a continuation of Applied Mechanics B–25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B–31. Preparation: B–23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B–31a. Preparation: B–23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B–32. Preparation: B–12, B–20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B–33. Preparation: B–32. This course is a continuation of B–32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser tests; non-condensing and condensing engine and turbine tests;

heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the selection of a site for a manufacturing plant; the investigation of the subsoils for the footing course of the foundation; wood; concrete and sheet steel piling; design of walls, beams, floors, windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

Principles of Marketing—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Textile Physics—B-37. Preparation: B-23. The work in this subject consists of experimental determinations of the physical properties of textile fibers, yarns and fabrics. Special emphasis is placed upon the study of properties which determine the color characteristics of textile materials. [Course VI, Design and Sales Options.]

Accounting—B-40. Preparation: B-10 and E-30. The purpose of the course in accounting is to acquaint the student with modern methods of accounting for mercantile and manufacturing businesses. At the same time it gives him a much-needed knowledge of such common elementary business transactions as are involved in the use of checks, drafts, notes, vouchers, bonds and stocks.

It is not the purpose of the course to make the student a proficient bookkeeper or accountant, but the nature of the work necessitates a basic knowledge of double-entry bookkeeping and of the functions of ledger accounts. This is developed in practice in the following manner: During the summer preceding the fourth year the student is required to work up a simple bookkeeping set, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The course includes a study of the balance sheet and profit and loss statement, and their construction in proper form. Attention is given to the principles of balance sheet valuation, and to such topics as depreciation, sinking fund reserves and the accounting for bond and stock issues.

One-half of the time scheduled for accounting is devoted to a study of Cost Accounting. It is designed to give the student a knowledge of the best cost methods in use at the present time, and involves a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses and the predetermination of costs. [Course VI.]

Microscopy—B-41. Preparation: B-23. This subject consists of the study of animal and vegetable fibres by means of the microscope and its accessories. It

includes sectioning and mounting, measurements of diameter and twist, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI. Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This work, given in the fourth year of the Textile Engineering course, covers a wide range of subjects and is of the most practical character possible. All of the student's previous work in engineering and his knowledge of the textile processes are here brought together in the consideration of the larger problems of mill design, construction and organization. After a detailed study has been made of the most modern types of mill buildings, including all calculations and drawings, the student is given the problem of laying out and completely designing a textile mill so far as time permits.

The modern methods of power transmission and the proper arrangement of textile machinery are also given careful consideration. The problems are in every case taken from actual conditions in mills already built or in process of construction. The questions of mill heating, ventilation, lighting, humidification and fire protection are also studied and the time spent in the drawing room enables the student to work out nearly all of the more important problems involved in the design of an entire textile mill plant. The close relation existing between proper plant design and economical production is also considered. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. In recognition of the great advances which have been made recently towards better methods of management, and of the possibilities which may result from its application to the textile industry, a course in business administration has been established to enable the student to understand and apply the principles and details of modern management. The instruction in this course begins with a consideration of the factory location and design and their effect on efficiency of production, after which the proper form of organization for manufacturing establishments is discussed in detail, together with organization charts and records.

This is followed by a study of the details of the work of the various departments, such as purchasing, manufacturing, planning, etc., and includes such topics as purchasing systems, storekeeping, perpetual inventories, warehousing, scheduling routing, tracing, timekeeping, motion studies, time studies, mnemonic symbolizing'

graphical records, wage systems, etc. Consideration is also given to the important relation of psychology to efficient management.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, negotiable instruments, sales, bills of lading, real estate and corporation. [Course VI.]

Mill Illumination—B–47. Preparation: B–23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: B–37, D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparation: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C–10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

Non-Metallic Elements.—Their occurence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Their occurrence, properties, metallurgy, chemical compounds, etc.

Theoretical Chemistry.—Fundamental laws and the theories of chemistry including chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ, valence, periodic law, etc.

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and the laboratory periods wholly to qualitative analysis, listed below as C–11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–11. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–11a. Preparation: C–10, taken simultaneously. This course is similar to C–11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–12. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, B–12, B–14. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C–20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required

to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C–22. Preparation: C–10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dyestuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C–23. Preparation: C–11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Smith's "Quantitative Chemical Analysis" is used as a text. [Course IV.]

Stoichiometry—C–24. Preparation: B–10, C–10, C–12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C–30. Preparation: C–23. The fundamental principles acquired in Course C–23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, textile fabrics, stripping agents, acids and alkalies. The latest and most practical methods are employed. Griffin's "Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C–31. Preparation: C–22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Read's "Industrial Chemistry." Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–32. Preparation: C–20, C–21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color

contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Photography—C-37. Preparation: B-23, C-20, C-22, C-23. Photography is today indispensable to the scientist and textile chemist. Without the aid of photography he cannot preserve and keep an absolute and accurate record of his investigations and research problems.

The Institute therefore offers to the Senior Chemists an eight-weeks' course in the elements of Photography. One object of this course is to provide the student with the preliminary knowledge and training necessary for the course in Microscopy and Photomicrography which follows.

The course includes a study of the different types of cameras and lenses, the making of contact prints from classified negatives using various grades of papers, reduction and intensification of negatives, enlarging, copying, negative making and lantern slide preparation.

The theory and chemistry of the above subjects are not only covered in the classroom but in addition all of this work is actually carried on by each individual student in the Photographic Laboratory and Dark Room. [Course IV.]

Technical German—C-40. Preparation: C-35. This is a continuation of Technical German C-35. [Course IV.]

Organic Chemistry Laboratory—C-41. Preparation: C-34. This is a continuation of Organic Chemistry Laboratory C-34. [Course IV.]

Industrial Chemistry—C-42. Preparation: C-31. This is a continuation of Industrial Chemistry C-31. [Course IV.]

Chemical Textile Testing—C-43. Preparation: C-21, C-32. A series of lecture and laboratory periods covering the theory and use of the instruments and apparatus used in testing and evaluating textile materials. Emphasis is given to those tests which may be used to give a chemist valuable information as to the source and quality of textiles. The last part of the work consists of chemical and optical tests which may be necessary to a textile chemist in either routine or research work. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-44. Preparation: C-32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C-45. Preparation: B-23, C-20, C-22, C-37. The value of the microscope in the identification of textile materials and the examination of textile yarns and fabrics cannot be overestimated. In conjunction with photomicroscopy a permanent record which may be filed for future reference and which is understandable by non-technical men is obtained.

In this course the students are given instruction in the use and construction of various types of microscopes and accessories; the preparation and mounting of samples; the identification of starches and fibers; microchemical reactions; and

examination of fabrics for faults. Actual unknown fibers, starches and fabrics are examined and reported upon.

Following microscopy, the student takes up photomicroscopy, for which he has been prepared by a thorough course in the common processes of photography. The types and constructions of photomicrographic apparatus, adjustments, and exposures are taught by actual work in the photomicrographic laboratory. The student studies the use of such auxiliaries as color filters, polarized light, dark-ground illumination, color photography, and works at both high and low magnifications. At the end of the course the student is given a typical industrial or research problem on which he works independently and upon which he must prepare a complete report, illustrated by appropriate photomicrographs. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The purpose of this course is to enable the student to write a technical report clearly. An analysis of a complete research is first made. This is followed by a bibliography and instructions in the use of reference books and technical journals. Methods of obtaining and interpreting laboratory data are given and the elements of statistical analysis demonstrated and used. Instruction and illustrations of various technical and non-technical, formal and informal, laboratory and plant reports are given. [Course IV.]

Textile Literature—C–48. Preparation: C–47. The object of this course is to introduce the student to the current sources of information on textile chemical subjects. Each student is assigned a subject and is required to keep informed on that subject by first a survey of the literature and then the reading of current technical journals. Reports are tendered informally and orally. [Course IV.]

Advanced General Chemistry—C–49. Preparation: C–10, C–11, C–24, C–34, C–42, C–46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Engineering Chemistry—C–50. Preparation: C–22, C–23. This course consists of a series of lectures covering the derivation, sampling, analysis, and specification of coals, gasolines, kerosenes, fuel gases, flue gases, oils, greases, and boiler waters. This is followed by a study of combustion and the underlying principles of lubrication. The lectures are supplemented by laboratory work consisting of complete analyses of coal, gasoline, oil, grease, flue gas, and illuminating gas. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C–51. Preparation: C–32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Optional Subjects or Thesis during fourth year—C–52. Preparation: Satisfactory completion of all first and second year subjects in Course IV.

The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take optional work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931–32 several options were introduced, each optional period being 45 hours per term and four of these being required during the year.

If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more option periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or optional subjects, will be required for graduation.

Options: Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry varying from year to year.

Photomicroscopy. A series of laboratory experiments followed by a research problem in photomicroscopy. Effects of the optical system, exposure, polarized light and dark ground illumination are studied and color photomicroscopy is included as far as time permits.

Colloid Chemistry. A seminar course on general colloid chemistry with special applications to textiles. The colloid chemistry of dyeing, the action of detergents, and the swelling effects of various materials on the fibers are especially emphasized.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conductivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn cal-

culation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves,

pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options C, D, S.]

Jacquard Design—D–31. This is a continuation of Jacquard Design D–23. [Course III.]

Power Weaving—D–32. Preparation: D–20, D–21, or D–23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Jacquard Design and Weaving—D–40. Preparation: D–23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D–41. Preparation D–10, D–20, D–21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E–10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E–11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is ele-

mentary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

COTTON DEPARTMENT—F

Cotton Carding—F-20. Preparation: B-10, B-12, B-14. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as

eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin and Nasmith combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine and jack are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F–20a. Preparation: B–10, B–12, B–14. This course is similar to Course F–20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions.

The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II.]

Knitting—F–31a. Preparation: B–12, D–10. This course embraces the same lectures as Course F–31 but does not include any laboratory work. [Course VI, Options G, C, W, S.]

Cotton Organization—F–32. Preparation: F–20 or F–20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Thesis—F–34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

WOOL DEPARTMENT—G

Fiber Preparation—G–20. Preparation: B–10, B–12, B–13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in washing; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the

hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.—Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning.—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W, D, S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G-31. Preparation: B-23, F-30 or G-30, D-24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course

of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool and Allied Fibers—Lectures and Demonstrations—G–40. Preparation: C–21, C–32, D–10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H–30. Preparation: B–12, C–10, D–10, D–24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods

of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H–31. Preparation: B–12, C–10, D–10, D–24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shares for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

STARCH MANGLES.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

DRYERS AND STRETCHERS.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

CALENDERS.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time, and each year some new machine will be added by a manufacturer who finds it to his advantage to be represented here. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of two Kitson pickers, one 40-inch two beater breaker lapper with an automatic feeder and one 40-inch finisher lapper with a Perham and Davis evener. There is an extra Kirschner patent carding beater to be used in this finisher picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops. One of these is equipped with a Chapman electric neutralizer to prevent trouble from static electricity.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. One frame is equipped with both common and metallic drawing rolls, electric stop motions and Ermine top roll clearers. The other frame and the railway head both are equipped with metallic rolls and mechanical stop motions. Another frame of two deliveries

is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough. The last named serves to illustrate the common English construction and how it differs from the American construction as illustrated in the other roving machines.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the LeBlan Roth long draft system, while another has a special five roll long draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball bearing spindles. Four of these frames are equipped with individual motor drives,—one chain drive, one Texrope drive, one gear drive and one Washburn clutch drive. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller bearing spindles and is fitted on one side with Casablanca long draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long draft system. This machine is equipped with an individual alternating current motor with a chain drive. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.'

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. This equipment is suitable to spin coarse numbers from cotton wastes to be used in such materials as coarse sheeting, osnaburgs, twine and mop yarns.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired percent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. In addition, there is a gas conditioning oven to use in determining moisture content and regain. A number of scales and balances, together with yarn reels, roving reels and measuring boards make up the equipment for routine mill sizing tests.

Knitting Section.—The winders for this section include a six-spindle Universal winder for cones and tubes and a Payne bobbin winder.

The machines in the following group are equipped with special attachments for producing high splicing, double soling and striped work. The hosiery machines

include two Acme full automatic, one arranged for 160 needles and the other for 200 needles; also a Mayo Model C full automatic arranged for 220 needles. Scott & Williams have placed in this section four of their machines, Models B-5, K, HH and RI. There are three Banner machines, all full automatic, two of which are arranged for 220 needles each and one arranged for 160 needles. There is one Brinton full automatic arranged for 176 needles and one Branson hand machine arranged for 80 needles. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division.—The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company of North Andover, Mass.: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company; one mule headstock mounted on trucks for instruction purposes; one fancy yarn twister with chain and gear equipment; one filet winding drum stand with tension bars, wind, etc., for applying card clothing.

Installed by C. G. Sargent's Sons Corporation, Graniteville, Mass.: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc., of Worcester, Mass.: One 120-spindle cam mule complete; one mule headstock mounted on trucks for instruction purposes.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son, Worcester, Mass.: One card grinding stand with two traverse grinders complete.

Equipment: Modern ferrule type fiber head jack spools and bobbins by U. S. Bobbin and Shuttle Company of Lawrence; yarn baskets by Steele Supply Company, Cambridge, Mass.; hand cards by Howard Brothers of Worcester and Davis & Furber Machine Company; ring travellers by Victor Company; static suppressors by Chapman Neutralizer Company.

Shoddy or Reworked Fiber Division.—Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division.—Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., Leeds, England, equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops of Biddeford, Me.; two worsted combs with baller punch, one made by Crompton & Knowles, Worcester, and the second made by James Smith & Sons, of Worcester, Mass.; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stell, Keighley, England.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, Keighley, England, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap spinner, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer spinner, one 12-spindle ring spinner, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. In addition to this the Saco-Lowell Shops, Biddeford, Me., have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system through its automatic control. In this laboratory are installed six humidifiers and four Comin's High Duty heads, which are supplied from an electric-driven triplex power pump located in the power house. This same pumping equipment supplies the American Moistening Company's humidifiers operating in the Cotton Yarn Department.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning, the machinery has been made by the Société Alsacienne de Constructions Mechaniques, Mulhouse, France, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads), gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twelve turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company, Fitchburg, Mass. The com-

pressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

Textile Testing Division.—Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company of Boston; single yarn and fabric strength-testing machines made by G. R. Smith & Company, Bradford, England; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper, Leipzig, Germany. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company of Providence, R. I., a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, also an abrasion machine for testing resistance to wear of twines, tapes, and all stripped flat fabrics, one General Electric mercury vapor lamp with stand for top inspection. For the automatic control of temperature and humidity there has been installed by the American Moistening Company, of Boston, one of its automatic humidity and temperature regulators.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company of New York.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, besides a slasher for preparing cotton warps; a high speed warper, by T. C. Entwistle Company of Lowell. The Whitin Machine Company, Whitinsville, Mass., has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, Worcester, Mass., a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8-spindle doubler. Also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company of North Andover, Mass.

The Weaving Department contains four looms supplied by the Draper Corporation of Hopedale, Mass., which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company of Readville, Mass., has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, Whitinsville, Mass., a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company, Lisbon Falls, Maine. The Hopedale Manufacturing Company of Milford, Mass., has recently installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 16-harness lappet loom, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company, Clinton, Mass. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons, Paterson, N. J.; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table, with ample facilities to provide distilled water through the use of a Barnstead Water Still. The Balance Room, which is adjacent to the laboratory, has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé refractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with individual benches, small dyeing apparatus, reels, balances, apparatus for dye testing, such as frames for exposing dyed material to light, and a complete collection of dyestuff samples and sample cards. There are also fifty-six steam coil experimental dyeing baths, a drying chamber and ageing chamber, in addition to a Hurricane Dryer, Class D, made by the Philadelphia Drying Machinery Company, Pennsylvania. Adjacent to the Experimental Dyeing Laboratory there has been provided a well-lighted room for the storage of a great variety of dyestuffs. Steel shelving has been arranged so that the samples are easy of access. All samples are catalogued in a card file, thus facilitating their use.

The Industrial Chemistry Laboratory contains the following: one filter press, Type E. T. Shriver & Company; a single-acting triplex plunger pump, Goulds Manufacturing Company; a vacuum drying apparatus, a surface condenser, a Packard vacuum pump, Norman Hubbard's Sons; a vacuum evaporator, Swenson system, American Foundry and Machine Company; a centrifugal, C. H. Chavant & Company; a double jar mill, F. I. Stokes & Company.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, Worcester, Mass., a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter, the Permutit Company, New York City; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine, the Textile-Finishing Machine Company, Providence, R. I.; a set of drying cans by the same concern; a chain dyeing machine, T. C. Entwistle Company, Lowell, Mass.; a raw stock drying table, Proctor & Schwartz, Philadelphia, Pa.; a padding mangle, Arlington Machine Works, Arlington, Mass.; a hydro-extractor, W. H. Tolhurst & Son, Troy, N. Y.; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. The Franklin Process Company, Providence, R. I., has furnished a 25-pound bronze dyeing machine. Of the various dye tubs, one is equipped with a Monel metal lining to withstand the action of various chemicals and dyes.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company, Orange, Mass.; a sample fulling mill, a kicker mill, furnished by James Hunter & Company, North Adams, Mass.; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company of Worcester has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air-cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson, Springfield, Vt.; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co., Woonsocket, R. I.; a tentering and drying machine furnished by John Heathcote, Providence, R. I.; a single crabbing machine, H. W. Butterworth & Son, Philadelphia, Pa.; a 72-inch woolen napper donated by Davis & Furber, North Andover, Mass.; a 32-inch basket hydro-extractor, W. H. Tolhurst, Troy, N. Y.; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company, New York; a steam press for underwear, United States Hoffman Company, Syracuse, N. Y.; a sewing machine, Birch Brothers, Somerville, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.

The Cotton section includes a 40-inch inspecting and brushing machine, a

44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company, Worcester, Mass.; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company, Salem, Mass.; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers, Somerville, Mass.; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber, North Andover, Mass. (the ball bearings were donated by the Fafnir Bearing Company, New Britain, Conn.); an 8-inch belt lacer furnished by the Clipper Belt Lacer Company of Grand Rapids, Mich.; a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company, Boston; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system, Files Engineering Company, Inc., Bridgeport, Conn.; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company, Providence, R. I.; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company, Providence, R. I.; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company, Boston, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company, Philadelphia, Pa. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company, Boston, Mass.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alder absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments. For the measurement of flow of air there are a steam-driven Sturtevant fan and a motor-driven Massachusetts fan with heater combined for heating and drying experiments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-Kilowatt rotary transformer and three Westinghouse stationary transformers. The other section of the laboratory is known as the instrument laboratory and is for the purpose of giving instruction in the measurement of current voltage, resistance, and in the calibration of instruments. It contains a 5-kilowatt Crocker-Wheeler balancer, a 160-ampere hour storage battery, a 5-kilowatt 220-volt to 440-volt General Electric transformer, a Westinghouse portable wattmeter with current and potential transformers, three wattmeters, two ammeters and a voltmeter, all of the General Electric portable alternating current type, a 30-volt alternating current Roller Smith voltmeter, a 5 to 10-scale Weston ammeter (electro-dynamometer type), a Weston millivoltmeter with 2, 20, 50 and 200 ampere shunts, three 250-volt direct current Weston voltmeters, a 150-ampere,

two model 45, two model 260, Weston portable ammeters, a Weston model 260 voltmeter, a Thompson 50-ampere recording wattmeter, a General Electric rotating standard wattmeter, two General Electric induction type watt hour meters, an Esterline portable curve drawing wattmeter, a 100-ampere Leeds & Northrup Standard Resistance, a Leeds & Northrup Ayrton shunt, a Weston laboratory standard voltmeter with 600-volt multiplier, a Leeds & Northrup potentiometer, a D'Arsonval wall type galvanometer, a Wheatstone bridge with galvanometer, a slide wire bridge and electro-dynamometer, Weston Standard cell, potential phase shifter, a standard Leeds & Northrup photometer with Lummer-Brodhun screen, and Macbeth illuminometer made by the same concern.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10-foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company, Nashua, N. H.; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company, Worcester, Mass.; an engine lathe, 18-inch swing, 6-foot bed from Champion Tool Works, Cincinnati, Ohio; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons, Fitchburg, Mass.; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company, Milwaukee, Wis.; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company, Nashua, N. H.; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son, Worcester, Mass.; one 14-inch single sensitive drill, from the Stanley Manufacturing Company, Lawrence, Mass.; one No. 1 Universal grinder, from Landis Tool Company, Waynesboro, Pa.; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount, Everett, Mass.; an American twist drill grinder, from the Heald Machine Company, Worcester, Mass.; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company, Cincinnati, Ohio; one 30-inch grindstone and frame, from the Athol Machine Company, Athol, Mass.; a single spindle centering machine, from D. E. Whiton Machine Company, New London, Conn.; one 15-inch shaper, from Potter & Johnson, Pawtucket, R. I.; one power hacksaw, from the Fairbanks Company, Boston, Mass.; one cold saw, from John T. Burr & Son, Brooklyn, N. Y.; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

Power, Light, Heat and Ventilating Plant.—In the powerhouse there is located the main power-generating apparatus for supplying light, heat and power to all departments of the Institute. The equipment here consists of: two 250-horsepower Heine water tube boilers, one equipped with a Jones stoker and one with Perfection grate, a 300-horsepower Aultman & Taylor horizontal water tube boiler, equipped with United States rocking grates, two boiler feed pumps—one a Knowles and the other a Deane—a 40,000-pound Cochrane metering open-feed heater, which is provided with a Lea recorder, and a Cochrane oil extractor which heats and measures all feed water, a 3-inch Venturi meter in feed line with indicating manometer as made by the Builders Iron Foundry, Providence, R. I. In the Engine Room are located: a Payne 14 by 14 automatic high speed engine, 125-horsepower direct connected to 75-kilowatt, 220-volt, direct-current Bullock generator, a 9½ by 11 Nash gas engine of 50-horsepower, 4-cycle type, direct connected to a 30-kilowatt, 220-volt, direct-current Bullock generator, a 65-kilowatt motor generator set, consisting of a direct current motor and an alternating current generator made by the Westinghouse Electric and Manufacturing Company. A steam-driven Ingersoll-Rand 8 by 8 air compressor, for use with Turbo heads, installed in the French Spinning Department by the G. M. Parks Company, Fitchburg, Mass. The station switchboard is of marine-finished slate, 90 inches in height, and consists of three generator panels and two circuit panels.

The powerhouse is connected with the main school buildings by a tunnel through which all wires, steam and water pipes are carried.

GRADUATES WITH TITLES OF THESES

June 6, 1933

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Textile Chemistry and Dyeing, no thesis subjects have been listed.

Edward Babigan	Lowell, Mass.
Phillip Edward Dempsey	Monson, Mass.
Haig Markarian	Lowell, Mass.
John Joseph Murphy	Lowell, Mass.
Joseph James Pizzuto, Jr.	Pittsfield, Mass.
Gerald Adelbert Robillard	Lowell, Mass.
Aimé Albert Savard, Jr.	Lowell, Mass.
Kenneth Lawrence Stearns	Lowell, Mass.
David Henry Turcotte	Lowell, Mass.
Henry Alfred Wells, Jr.	Elizabeth, N. J.
Stanley Edward Wojas	Lowell, Mass.
Edmund Joseph Young, Jr.	Lowell, Mass.

Bachelor of Textile Engineering

Albert Richard Dudley, Lowell, Mass. "A Study of the Possibility of Using the Verigraph to Determine the Regain of Textile Fabrics."

Jesús Fortunato Echecopar, Lima, Peru. "The Effect of Regain on the Tensile Strength and Elongation of Woolen Yarns."

Morris Lifland, Roxbury, Mass. "A Study of the Measurement of Luster of Textile Fabrics."

Theodore Recher, North Providence, R. I. "The Determination of the Relation between the Weave and the Strength of Cotton Textile Fabrics."

Diploma Graduates

Wool Manufacture

Eugene Francis Crane, Lowell, Mass. "The Manufacture of a Fancy Worsted."

Judson Pickering Morse, Danvers, Mass. "The Manufacture of a Melton Overcoating."

Textile Design

Cabot William Penney, Methuen, Mass. "The Evolution of Color from White to Multicolors in a Piece of Dress Goods."

Prizes awarded in June, 1933

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *Cabot William Penney.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Joseph James Pizzuto, Jr.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Ernest Lorenzo Dion.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *James Campbell de Gruchy, Jr.* Honorable mention, *Joseph Shain* and *Howard Nathaniel Stolzberg.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Lee Gale Johnston.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Herbert Alvin Wormwood.* Honorable mention, *Bernard James Tyler* and *Moushy Markarian.*

REGISTER OF DAY STUDENTS

Candidates for Degree

Class of 1934

Home Address	*Lowell Address*
Allen, Grover Stanley, IV, Haverhill, Mass.	———
Beigbeder, Edgar Raymond, IV, Roslindale, Mass.	Omicron Pi House
Birtwell, John Lincoln, IV, East Chelmsford, Mass.	———
Bukala, Mitchell John, IV, Lowell, Mass.	3 Osgood Avenue
Donohoe, Edward Joseph, VI, Lowell, Mass.	49 Butterfield Street
Dunlap, Parker Frank, VI, Billerica, Mass.	———
Forsythe, George, VI, Andover, Mass.	———
Fox, David James, VI, Lowell, Mass.	359 Beacon Street
Gifford, Alden Ives, Jr., VI, Lowell, Mass.	18 Marlborough Street
Gillespie, Francis Clifford, IV, North Andover, Mass.	———
Glowienski, Mitchell, IV, Lowell, Mass.	198 West Sixth Street
Graham, Robert Theodore, IV, North Andover, Mass.	———
Gregory, Robert Crockett, VI, Rockland, Me.	Omicron Pi House
Hallissy, John Joseph, VI, Manchester, Mass.	Phi Psi House
Henderson, Robert James, IV, Swampscott, Mass.	Omicron Pi House
Kidder, Glen Mortimer, IV, Ayer, Mass.	———
Lawson, Russell Munroe, VI, Andover, Mass.	———
Leblanc, Gerald Alderic, VI, Lowell, Mass.	86 White Street
Leslie, Kenneth Everett, IV, Haverhill, Mass.	———
Matthews, Raymond Lewis, IV, Gardner, Mass.	Omicron Pi House
Moody, Leon Eugene, IV, Lowell, Mass.	40 Riverside Street
Morrison, Roland Charles, IV, Dracut, Mass.	———
Shah, Shantilal Hiralal, IV, Bombay, India	53 Mt. Hope Street
Shapiro, Simon, VI, Lowell, Mass.	84 Cambridge Street
Smith, Harold, IV, Lowell, Mass.	24 Belmont Street
Thomas, Benjamin, Jr., VI, Nashua, N. H.	———
Thomas, Robert Joseph, IV, Lowell, Mass.	24 Loring Street
Wilkie, Robert Campbell, VI, Newton Centre, Mass.	Omicron Pi House
Wynn, William Joseph, IV, Lowell, Mass.	4 Ames Place

Class of 1935

*Abrahamian, Aram, IV, Watertown, Mass.	———
Alcott, Albert Stephen, Jr., IV, Lowell, Mass.	59 Canton Street
Beattie, John Silas, IV, Lowell, Mass.	285 Foster Street
Bogdan, John Francis, VI, Nashua, N. H.	———
Bradford, Edward Hosmer, VI, Andover, Mass.	———
Burke, Joseph Thomas, VI, Lowell, Mass.	109 Tyler Park
Cobb, Joseph Calvin, VI, Lowell, Mass.	5 Dover Street
Cogswell, Frederick William, IV, Maynard, Mass.	———
Connolly, Daniel Francis, Jr., VI, Salem, Mass.	Phi Psi House
Cowan, Raymond Bernard, IV, Haverhill, Mass.	28 White Street
Curtin, William John, IV, Lowell, Mass.	49 Second Street
Daley, Charles Lincoln, IV, Lowell, Mass.	239 Stevens Street
deGruchy, James Campbell, IV, Stoneham, Mass.	———
Diehl, Fred Anton, VI, East Paterson, N. J.	Phi Psi House
Dion, Ernest Lorenzo, IV, Lawrence, Mass.	———
Dunn, Austin Pember, VI, Shirley, Mass.	———
Echavarria, Luis, VI, Medellin, Colombia	Phi Psi House
Eismann, Edmund, IV, Pawtucket, R. I.	9 White Street
Fairbanks, Evan Hobbs, VI, Wakefield, Mass.	———
Freeman, Arthur Samuel, VI, Chelsea, Mass.	28 White Street
Gagnon, Roland Octave, IV, Lowell, Mass.	279 Liberty Street

*Died Dec. 20, 1933.

Home Address	*Lowell Address*
GARNER, JOHN WILLIAM, IV, Kezar Falls, Me.	Omicron Pi House
GREENBAUM, HYMAN HERBERT, IV, Haverhill, Mass.	———
GRIFFIN, VERNON HARCOURT, IV, Swampscott, Mass.	Omicron Pi House
GROSSMAN, EDWARD, VI, Providence, R. I.	28 White Street
HARWOOD, RALPH, IV, Bronx, N. Y.	28 White Street
HEFFERNAN, JOHN VINCENT, IV, North Smithfield, R. I.	Phi Psi House
HOLDEN, ARTHUR NEWTON, VI, North Billerica, Mass.	———
JAREK, WALTER JULIUS, IV, Lowell, Mass.	74 Eleventh Street
KOPATCH, CHESTER MARION, IV, Lawrence, Mass.	———
LAUDER, ROBERT WILLIAM, VI, Haverhill, Mass.	Omicron Pi House
LOKUR, SWAMIRAO RAMRAO, B.S., IV, Ahmedabad, India	53 Mount Hope Street
MORENA, EMILIO GOMEZ, JR., VI, Graniteville, Mass.	———
PARECHANIAN, JAMES HUMPHREY, IV, Lowell, Mass.	1 Summer Court
PHELAN, LEONARD JOHN, IV, Ipswich, Mass.	137 Riverside Street
PLOVNICK, MAX DAVID, IV, Roxbury, Mass.	———
POREMBA, LEO LOUIS, IV, Lowell, Mass.	4 Oak Street
SCHOELZEL, HERMAN WALTER, IV, Methuen, Mass.	———
SHAIN, JOSEPH, IV, Roxbury, Mass.	35 White Street
STEIN, WILLIAM JOSEPH, VI, East Haven, Conn.	28 White Street
STOLZBERG, HOWARD NATHANIEL, IV, Haverhill, Mass.	28 White Street
STOREY, EDWIN GERALD, VI, Chatham, N. J.	43 Plymouth Street
SULLIVAN, JOSEPH AUGUSTUS, VI, Lowell, Mass.	28 Grove Street
THOMPSON, GEORGE ROBERT, IV, Lowell, Mass.	39 Roper Street

Class of 1936

ANTHONY, HENRY STEERE, IV, Lowell, Mass.	20 Loring Street
BASDIKIS, CHARLES APOSTOLOS, IV, Lowell, Mass.	8 Lagrange Street
BATES, WESLEY ELLIOT, VI, East Milton, Mass.	———
BERG, ABRAHAM DAVID, VI, Brooklyn, N. Y.	28 White Street
CLARKE, JOHN THOMAS, VI, Chelmsford, Mass.	———
CONANT, GILMAN WRIGHT, VI, Newtonville, Mass.	100 Riverside Street
CRAWFORD, ROBERT THOMAS, VI, Boston, Mass.	———
CROWLEY, MARGARET HELEN, IV, Lowell, Mass.	611 Stevens Street
FARKAS, ZOLTAN ROLAND, IV, New York, N. Y.	32 Mt. Washington Street
FULLER, ROLAND MONROE, VI, Tewksbury, Mass.	———
GEORGACOULIS, GEORGE, IV, Lowell, Mass.	336 Suffolk Street
HIRSCH, EMANUEL HERMAN, VI, Weehawken, N. J.	43 Plymouth Street
HODGMAN, RICHARD ALBERT, VI, Stoneham, Mass.	———
HOLGATE, BENJAMIN ALEXANDER, VI, Lowell, Mass.	97 Grove Street
IRELAND, WILSON GERARD, VI, Melrose, Mass.	137 Riverside Street
JOHNSTON, LEE GALE, IV, Haverhill, Mass.	———
KAISER, JOHN RAYMOND, VI, Bloomfield, N. J.	65 Sterling Street
KENNEDY, ROBERT GILMAN, IV, Lowell, Mass.	223 Pine Street
LANDAU, DAVID, IV, Brooklyn, N. Y.	28 White Street
LANGIS, PAUL HENRI, IV, Lowell, Mass.	115 Mt. Washington Street
LEBEL, CLAUDE MERWIN, VI, New York, N. Y.	43 Plymouth Street
LINCOLN, CHARLES ERNEST, IV, Mattapan, Mass.	43 Plymouth Street
LUESCHER, FRANK OSCAR, IV, Pawtucket, R. I.	9 White Street
MCQUADE, ALLAN JOHN, VI, Lowell, Mass.	600 Andover Street
MARKARIAN, MOUSHY, IV, Lowell, Mass.	103 Lawrence Street
MULLER, PAUL JOHN, VI, Weehawken, N. J.	43 Plymouth Street
OLCOTT, HARRY DEPEW, IV, Lowell, Mass.	56 Montview Avenue
OLSHINSKI, MATTHEW JOHN, VI, North Chelmsford, Mass.	———
REDMOND, JAMES REYNOLDS, IV, Lowell, Mass.	84 Bartlett Street
ROARKE, JOHN JAMES, IV, Lowell, Mass.	75 Viola Street
SCHALLER, JOSEPH GREGORY, IV, Wellesley, Mass.	11 White Street
SHAH, KANTI KIRALAL, VI, Bombay, India	53 Mt. Hope Street

Home Address	*Lowell Address*
Shann, William Edwin, VI, Putnam, Conn.	Phi Psi House
Stevens, Dexter, Jr., VI, Warwick Neck, R. I.	124 Riverside Street
Thompson, Henry Albert, IV, North Tewksbury, Mass.	———
Tyler, Bernard James, IV, Lowell, Mass.	30 Epping Street
Tyler, Stanley Noyes, VI, Lowell, Mass.	338 Fairmount Street
Urbanetti, Anthony Joseph, IV, Manchester, Conn.	65 Sterling Street
Valentine, Preston Sumner, IV, Cochituate, Mass.	53 Mt. Hope Street
Welch, William Paul, IV, Lowell, Mass.	76 South Highland Street
Wormwood, Herbert Alvin, IV, North Wilmington, Mass.	———

Class of 1937

Allard, Frederick Pratt, IV, Lowell, Mass.	104 Eleventh Street
Bassett, Louis Loss, VI, New Haven, Conn.	28 White Street
Berg, Bernard Robert, VI, Brooklyn, N. Y.	28 White Street
Carroll, Hugh Francis, IV, Medford, Mass.	———
Churchill, Harry Coburn, IV, Lowell, Mass.	214 Third Street
Cutrumbes, Demosthenes John, IV, Dracut, Mass.	———
Daly, William James, VI, Andover, Mass.	———
Depoian, Vasken John, IV, Lowell, Mass.	8 Gates Street
Dick, Kenneth Paul, IV, Lowell, Mass.	22 Wetherbee Avenue
Dupee, George Richardson, VI, Lowell, Mass.	213 Branch Street
Elliott, Charles Henry, VI, Leicester, Mass.	137 Riverside Street
Fisher, Thomas Nathan, VI, Lowell, Mass.	100 Sanders Avenue
Hakanson, Gustave Warren, IV, Winchester, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	714 Gorham Street
Kelsey, Winfield Frederick, VI, Middletown, Conn.	50 Standish Street
Kiszka, Boleslaw Kazimierz, IV, Lowell, Mass.	211 Lakeview Avenue
Laurence, George Clough, VI, Summit, N. J.	37 Varney Street
Lemkin, Uriel William, VI, Lowell, Mass.	24 D Street
Leonard, William Wheeler, Jr., IV, Norwich, Conn.	Omicron Pi House
Lyle, Robert Keith, IV, Lowell, Mass.	86 Orleans Street
Megas, Charles, IV, Lowell, Mass.	114 Rock Street
Moushegian, Richard, IV, Lowell, Mass.	400 Central Street
Natsios, Basil Andrew, IV, Lowell, Mass.	98 Lewis Street
Nerney, Francis Xavier, IV, Lowell, Mass.	46 Dana Street
Redman, Howard Bliss, IV, Dracut, Mass.	———
Reed, Harold Ernest, IV, Nashua, N. H.	———
Regan, Paul William, IV, Lowell, Mass.	16 Linden Street
Rosenberg, Jacob, VI, Westerly, R. I.	28 White Street
Sadlier, William Francis, IV, Lowell, Mass.	385 Gorham Street
Spanos, James Peter, IV, Lowell, Mass.	14 West Bowers Street
Stanley, Donald Edward, IV, Lowell, Mass.	706 Stevens Street
Stokes, Alfred Roscoe, VI, Rumford, R. I.	11 White Street
Tonis, James William, IV, Brockton, Mass.	142 Riverside Street
Vaniotis, Socrates Vasilios, IV, Lowell, Mass.	13 Willie Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlborough Street
White, William Sayles, VI, Lowell, Mass.	29 Monadnock Avenue
Wilkinson, Herbert William, Jr., IV, Providence, R. I.	137 Riverside Street
Wright, George Ward, Jr., IV, Newton Centre, Mass.	65 Sterling Street

Diploma Students

Class of 1934

Bridges, Herbert Gardner, II, West Newbury, Mass.	43 Plymouth Street
Doyle, Kenneth Barr, II, Springfield, Mass.	Phi Psi House
Huyck, William Francis, II, Lowell, Mass.	157 Nesmith Street
Stevens, William Edwin, I, West Warwick, R. I.	137 Riverside Street

Class of 1935

Home Address	*Lowell Address*
Bogacz, John, III, Lowell, Mass.	53 Melrose Avenue
Boynton, Bradford Lewis, II, Andover, Mass.	———
Jessen, Robert Frederick, I, Whitinsville, Mass.	Omicron Pi House
Salpas, Cosmos George, III, Lowell, Mass.	232 Adams Street

Class of 1936

Beattie, Ralph William, III, Lowell, Mass.	285 Foster Street
Dursin, Louis Jules, II, Woonsocket, R. I.	793 Merrimack Street
Finlay, Harry Francis, Jr., II, Holbrook, Mass.	150 Riverside Street
Gould, Charles Edwin, II, Portland, Me.	148 Riverside Street
Raymond, Gardner Lawrence, III, Bedford, Mass.	———
Robbins, Lucy Wiley, III, Lowell, Mass.	102 South Loring Street
Wilson, Raymond Bachmann, II, Pawtucket, R. I.	146 Parkview Avenue

Special Students

Athanasopoulos, Louis Peter, III, Lowell, Mass.	235 Adams Street
Baranowski, John, III, Lowell, Mass.	4 Joiners Court
Bliss, Dorothy Myrtle, III, Chelmsford, Mass.	———
Campbell, Raymond Mellnotte, III, Lowell, Mass.	85 Hastings Street
Corlew, Rufus Edward, Ph.B., III, Lowell, Mass.	390 Wilder Street
Cwiklik, John Edward, III, Lowell, Mass.	84 Common Street
Dalphond, Alphonse, III, Dracut, Mass.	———
Dewey, William Tarbox, B.A., II, Quechee, Vt.	Marlborough Hotel
Dudley, Albert R., B.T.E., III, Lowell, Mass.	126 Coburn Street
Dupuis, Lucien Romeo, III, Lewiston, Me.	486 Merrimack Street
Kwarciak, Benjamin, III, Southbridge, Mass.	———
Laramy, Edwin, III, Concord, N. H.	———
Liebmann, Herman, IV, New York, N. Y.	43 Plymouth Street
Lord, Howard Foxon, B.C.E., III, Stoughton, Mass.	Phi Psi House
Mueller, Arthur John, III, Lawrence, Mass.	———
Nathan, Emanuel Geoffrey, A.B., II, Boston, Mass.	———
Papaconstantinou, Fotoula Argyres, IV, Lowell, Mass.	798 Rogers Street
Ripley, Franklin Fuller, B.A., II, Troy, N. H.	Marlborough Hotel
Schoonmaker, Weld Day, B.A., II, Ware, Mass.	43 Plymouth Street
Small, Raymond Lionel, IV, Waterville, Me.	Omicron Pi House

ALPHABETICAL LIST OF GRADUATES

The following list has been corrected in accordance with information received previous to February 1, 1934. Any information regarding incorrect or missing addresses is earnestly solicited.

B.T.C. indicates the degree of Bachelor of Textile Chemistry; B.T.D. indicates the degree of Bachelor of Textile Dyeing; B.T.E. indicates the degree of Bachelor of Textile Engineering; D indicates a diploma; C indicates a certificate (covering a partial course only). Degrees were issued beginning with the year 1913.

Abbot, Edward Moseley, II, '04 (D). Manufacturer, Abbot Worsted Company, Graniteville, Mass.
Abbott, George Richard, II, '08 (D). Andover, Mass.
Adams, Floyd Willington, VI, '16 (B.T.E.).
Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.
Adams, Tracy Addison, IV, '11 (D). Vice-President and General Manager, Arnold Print Works, North Adams, Mass.
Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.
Allard, Edward Joseph, IV, '31 (B.T.C.). Chemist, National Aniline & Chemical Company, Boston, Mass.
Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.
Anderson, Arthur Illman, IV, '24 (B.T.C.). Associate, Department of Research, Laundryowners National Association, Joliet, Ill.
Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City
Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Manville-Jenckes Company, Manville, R. I.
Anderson, Harold Robert, II, '26 (D). Research and Time Study Department, Abbot Worsted Company, Forge Village, Mass.
Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.
Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Dyer, Sayles Finishing Plants, Inc., Saylesville, R. I.
Arundale, Henry Barnes, II, '07 (D). Textile Analyst for G. H. Heath & Co., Ltd., Macclesfield, England, East Orange, N. J.
Atwood, Henry Jones, II, '23 (D). Assistant Superintendent, Daniels Manufacturing Company, East Brookfield, Mass.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.
Babigan, Edward, IV, '33 (B.T.C.). 121 Bellevue Street, Lowell, Mass.
Babigan, Raymond, IV, '24 (B.T.C.). Associate Examiner, United States Patent Office, Washington, D. C.
Bachelder, Charles Edward, IV, '24 (B.T.C.) Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.
Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). With Wannalancit Textile Company, Lowell, Mass.
Bailey, Joseph W., I, '99 (D). Agent, Booth Manufacturing Company, New Bedford, Mass.
Bailey, Lester Harold, IV, '24 (B.T.C.). Textile Chemist, American Printing Company, Fall River, Mass.
Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.
Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.
Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's, Norwood, Mass.
Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.
Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). With Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). Vice-President and Secretary, Walter Blue & Co., Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Lawyer, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin, I, '00 (D). Second Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). 31 Hoyt Avenue, Lowell, Mass.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beck, Frederic Christian, II, '24 (D). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl, VI, '30 (B.T.E.). Research Department, Pacific Mills, Lawrence, Mass.

Bell, Edward Benjamin, IV, '24 (B.T.C.). Textile Chemist, The Buromin Company, Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, Frank P. Bennett & Co., 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Industrial Engineer, Weybosset Mill, Providence, R. I.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). 30 West Street, Attleboro, Mass.

Blaikie, Howard Mills, II, '11 (D). 17 Maywood Avenue, Maywood, N. J.

Blake, Parker Gould, VI, '14 (D). District Manager, Claude Denis & Co., Ltd., Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). With Ludlow Manufacturing Associates, 80 Federal Street, Boston, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Salesman, The Huron Milling Company, Inc., 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Designer, Amoskeag Manufacturing Company, Manchester, N. H.

Boyd, George Andrew, I, '05 (D). Treasurer, Worcester Bleach & Dye Works Co., Worcester, Mass.

Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.

Bradford, Harold Palmer, II, '25 (D). 90 Beach Street, Malden, Mass.

Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.

Bradford, William Swanton, VI, '31 (B.T.E.). Assistant Superintendent, Dress Goods Division, Lawrence Manufacturing Company, Lowell, Mass.

Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.

Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.

Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.

Brainerd, Carl Emil, IV, '20 (B.T.C.). Superintendent of Dyeing, F. C. Huyck & Sons, Albany, N. Y.

Brandt, Carl Dewey, VI, '20 (B.T.E.). Head of Textile Engineering Department, Texas Technological College, Lubbock, Texas.

Brannen, Leon Vincent, III, '07 (C).

Brickett, Chauncy Jackson, II, '00 (D). Director, School of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.

Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.

Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears & Co., 65 Worth Street, New York City.

Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.

Brosnan, Willian Francis, IV, '27 (B.T.C.). Vice-President and General Manager, Antipyros Company, 338 Berry Street, Brooklyn, N. Y.

Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.

Brown, Philip Franklin, II, '23 (D). Manager, Special Products Section, DuPont Rayon Company, 350 Fifth Avenue, New York City.

Brown, Rollins Golthwaite, IV, '12 (D).

Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.

Brown, Will George, Jr., IV, '22 (B.T.C.). Chemist, American Hide & Leather Company, Lowell, Mass.

Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.

Buchan, Norman Spaulding, IV, '26 (B.T.C.). 36 Joliet Street, Laconia, N. H.

Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.

Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.

Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous Company, Lawrence, Mass.

Burns, Robert, IV, '28 (B.T.C.). Chemist, Celanese Corporation of America, Amcelle, Md.

Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Lowell, Mass.

Buzzell, Harry Saville, VI, '29 (B.T.E.). Color Technician, Oxford Paper Company, Rumford, Maine.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.

Campbell, Alexander, VI, '23 (B.T.E.). Mechanical Engineer, Charles T. Main, Inc., Engineers, 201 Devonshire Street, Boston, Mass.

Campbell, Allan, Jr., VI, '32 (B.T.E.). 601 East Eighth Street, South Boston, Mass.

Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.

Campbell, Orison Sargent, II, '03 (D). Manager, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B.T.C.). Textile Chemist, Sandoz Chemical Works, 36 Purchase Street, Boston, Mass.

Carleton, Joseph Raddin, III, '30 (D). Assistant Designer, The Bridgeport Coach Lace Company, Chelsea, Mass.

Carr, George Everett, I, '05 (D). Industrial Engineer, C. F. Mueller Company, 180 Baldwin Avenue, Jersey City, N. J.

Carr, Paul Edward, II, '24 (D). Designer, Cascade Woolen Mills, Oakland, Me.

Carter, Robert Albion, IV, '02 (D). District Sales Manager, E. I. du Pont de Nemours & Co., Birdsboro, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). Dyer, Hodges Finishing Company, East Dedham, Mass.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). Manager, Chandler Manufacturing Company, 56 Amherst Street, Cambridge, Mass.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Mill No. 1, Nantung, Kiangsu, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Vice-Principal, Hingham High School, Hingham, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.). Shanghai, China.

Chen, Wen-Pei, IV, '24 (B.T.C.).

Chisholm, Lester Bury, I, '11 (D). Textile Development, U. S. Rubber Company, Providence, R. I.

Church, Charles Royal, II, '06 (C). Physical Director, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clapp, F. Austin, II, '04 (D). Insurance Broker, White Plains, N. Y.

Clark, Earl William, IV, '18 (B.T.C.). Salem Depot, N. H.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). Dyer, Seamans & Cobb Thread Mills, Hopkinton, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Brown Hosiery Company, Lowell, Mass.

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Cleveland, Richard Sumner, VI, '30 (B.T.E.). Textile Research, National Bureau of Standards, Department of Commerce, Washington, D. C.

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Clogston, Raymond B., IV, '04 (D). Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.

Cluett, John Girvin, I, '29 (D). Textile Analyst and Assistant to Superintendent at Bleachery, Cluett, Peabody & Co., Inc., Peebles Island, Waterford, N. Y.

Coan, Charles Bisbee, IV, '12 (D).

Coffey, Daniel Joseph, III, '28 (D). Quality Man on Blankets, F. C. Huyck & Sons, Rensselaer, N. Y.

Cohen, Arthur Edward, IV, '23 (B.T.C.).

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Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.

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Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears & Co., 65 Worth Street, New York City.
Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.
Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.
Connorton, John Joseph, Jr., III, '27 (D). Designer, Amoskeag Manufacturing Company, Manchester, N. H.
Cook, Kenneth Bartlett, I, '13 (D). Technical Manager, Manville-Jenckes Company, Manville, R. I.
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Craig, Clarence Eugene, III, '02 (D).
Crane, Eugene Francis, II, '33 (D). 517 Westford Street, Lowell, Mass.
Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.
Crowe, Joseph Bailey, IV, '25 (B.T.C.). Textile Chemist, Procter & Gamble Co., Ivorydale, Ohio.
Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.
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Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.
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Currier, John Alva, II, '01 (D). Superintendent of Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.
Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.
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Cuttle, James H., II, '99 (D). Vice-President and General Manager, S. Stroock & Co., Inc., Newburgh, N. Y.

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Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd., (F. C. Huyck & Sons), Arnprior, Ont.
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Dewey, James French, II, '04 (D). President, A. G. Dewey Company, Quechee, Vt.
Dewey, Maurice William, II, '11 (D). Montpelier, Vt.
Dillon, James Henry, III, '05 (D).
Dods, James Barber, II, '27 (D). Vice-President and General Manager, The Dods Knitting Company, Ltd., Orangeville, Ont.
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Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.
Donovan, Joseph Richard, IV, '24 (B.T.C.).
Doran, Wilbur Kirkland, II '22 (D).
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Ferguson, Arthur Feiling, I, '03 (D).

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Fowle, Edwin Daniels, VI, '24 (B.T.E.). Associate Editor, "Textile World," 330 West 42nd Street, New York City.

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Fuller, Allen Reed, IV, '17 (B.T.C.). Textile Chemist, A. E. Staley Manufacturing Company, Decatur, Ill.

Fuller, George, I, '03 (D). Consulting Textile Specialist, Cox and Fuller, 320 Broadway, New York City.

Gahm, George Leonhard, II, '06 (D). Superintendent, Wood Worsted Mills, Lawrence, Mass.

Gainey, Francis William, IV, '11 (D). 81 Como Avenue, Buffalo, N. Y.

Gale, Harry Laburton, III, '10 (D). With J. P. Stevens Company, 44 Leonard Street, New York City.

Gallagher, Arthur Francis, IV, '30 (B.T.C.). Overseer of Dyeing, Hillsborough Mills, Wilton, N. H.

Gallagher, John Waters, II, '27 (D). 19 Robinson Avenue, Danbury, Conn.

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Garner, Allen Frank, II, '30 (D). Assistant Superintendent, Kezar Falls Woolen Company, Kezar Falls, Me.

Gaudet, Walter Urban, II, '29 (D). Resident Engineer, Liberty Mutual Insurance Company, Charlotte, N. C.

Gay, Olin Dow, II, '08 (D). President, Gay Brothers Company, Cavendish, Vt.

Gerrish, Walter, III, '03 (D).

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Gillon, Sara Agnes, IIIb, '06 (C).

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Gleklen, Leo, IV, '32 (B.T.C.). Assistant Dyer and Chemist, Hope Knitting Company, Pawtucket, R. I.

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Goodhue, Amy Helen, IIIb, '00 (C). See Harrison, Mrs. Arthur.

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Greenbaum, Herbert Baron, III, '29 (D).

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Hale, Ralph Edgar, IV, '31 (B.T.C.). Textile Chemist, The Bell Company, Worcester, Mass.
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Harmon, Charles Francis, I, '99 (D).
Harrington, Thomas, IV, '15 (D). Superintendent, Monarch Leather Company, 1127 West Division Street, Chicago, Ill.
Harris, Charles Edward, I, '05 (D). Superintendent, Martin Rocking Fifth Wheel and Trailer Company, Westfield, Mass.
Harris, George Simmons, I, '02 (C). Treasurer, Springs Cotton Mills, Charlotte, N. C.
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Hart, Arthur Norman, IV, '19 (B.T.C.).
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Haskell, Walter Frank, IV, '02 (D). Overseer of Dyeing, Dana Warp Mills, Westbrook, Maine.
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Hathaway, William Tabor, II, '26 (D). Civil Engineer, United States Coast and Geodetic Survey, Boston, Mass.
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Haynes, Amos Kempton, IV, '29 (B.T.C.). Sales Representative and Demonstrator; Rohm & Haas Co., Inc., 1109 Independence Building, Charlotte, N. C.

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Hendrickson, Walter Alexander, II, '11 (D). With National Knitting Company, Milwaukee, Wis.

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Horsfall, George Gordon, II, '04 (C). Assistant Dyer, Interwoven Mills, Inc., Martinsburg, W. Va.

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Hosmer, Frank Barbour, IV, '31 (B.T.C.).

Houghton, Robert Kingsbury, IV, '23 (B.T.C.). Chief Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.

Howard, Lorne Fernley, IV, '32 (B.T.C.). Salesman, George Mann & Co., Providence, R. I.

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Hunt, Chester Lansing, III, '05 (C).
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Jones, Nathaniel Erskine, I, '21 (D). Assistant Superintendent, E. L. Watkins Company, Portland, Maine.
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Kaatze, Julius, VI, '22 (B.T.E.).
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Lane, John William, I, '06 (C).
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Laughlin, James Knowlton, III, '09 (D).
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Neugroschl, Sigmond Israel, I, '21 (D).
Newall, J. Douglas, IV, '09 (D). Superintendent, Bondsville Bleachery & Dye Works, Bondsville, Mass.
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Niven, Robert Scott, VI, '12 (D). Draftsman, General Electric Company, Lynn, Mass.
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O'Donnell, John Delaney, I, '04 (C).
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Peabody, Roger Merrill, II, '16 (D).

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Prince, Sylvanus Cushing, VI, '08 (D).

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Savery, James Bryan, II, '23 (D). Assistant Sales Manager, Philgas Company, Windsor, Conn.

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Sawyer, Richard Morey, VI, '27 (B.T.E.). **(M.S., 1929, Massachusetts Institute of Technology.)** Cost Engineer, Firestone Cotton Mills, New Bedford, Mass.

Scanlon, Andrew Augustine, IV, '26 (B.T.C.).

Schaetzel, André Paul, IV, '21 (B.T.C.). Chemist, Associated Dyeing & Printing Corporation, Paterson, N. J.

Schneiderman, Jacob, III, '27 (D). Golf Professional, Fairview Country Club, Cumberland Center, Maine.

Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Assistant to New England Industrial Manager, Tide Water Oil Company, Boston, Mass.

Schwarz, Herman Louis, IV, '22 (B.T.C.). Color Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.

Scott, Gordon Maxwell, IV, '20 (B.T.C.).

Shaber, Hyman Jesse, VI, '17 (B.T.E.) **(M.B.A., 1922, Harvard University.)** With Spencer Chain Stores, Boston, Mass.

Shanahan, James Edward, II, '22 (D). Manager, Hygeia Ice & Coal Company, Amsterdam, N. Y.

Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C). Occupational Therapist, Sunshine Sanatorium, Grand Rapids, Mich.

Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.

Shea, John Francis, IV, '28 (B.T.C.). Chemist, Buffalo Electro-Chemical Co., Inc., 72 Granite Street, Boston, Mass.

Shedd, Jackson Ambrose, III, '28 (D). Designer, Lincolnfield Mill, Inc., Lincoln, Maine.

Shelton, Charles Leopold, VI, '29 (B.T.E.). Assistant to Merchandising Manager, Mohawk Carpet Mills, Amsterdam, N. Y.

Shenker, Nahman, III, '25 (D).

Sidebottom, Leon William, IV, '11 (D). Chemist, Boston Blacking & Chemical Company, East Cambridge, Mass.

Sjostrom, Carl Gustof Verner, Jr., III, '17 (D).

Slamin, Alfred Francis, I, '26 (D). Representative, Benjamin Franklin Paint Company, Philadelphia, Pa.

Sleeper, Robert Reid, IV, '00 (D). Textile Colorist, Calco Chemical Company, Bound Brook, N. J.

Smith, Allen Batterman, I, '26 (D). Head of Mill Department, Turner Halsey Company, 74 Leonard Street, New York City.

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Smith, Frank Kenfield, II, '24 (D). Designer Technician, Grout's, Ltd., St. Catharines, Ont.

Smith, Herbert Jeffers, VI, '22 (B.T.E.). Overseer of Ring Spinning, Potter Fine Spinners, Inc., Pawtucket, R. I.

Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.

Smith, Roger Dennis, II, '27 (D). With Marland Mills, Andover, Mass.

Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.

Smith, William Charles, IV, '26 (B.T.C.). Research Associate, American Association of Textile Chemists & Colorists, Bureau of Standards, Washington, D. C.

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Sokolsky, Henry, VI, '17 (B.T.E.). Time Study Supervisor, B. F. Sturtevant Company, Hyde Park, Mass.

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Stacey, Alfred Charles, IV, '30 (B.T.C.). 9 Brook Street, Andover, Mass.
Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.
Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist and Overseer of Bleaching, Certified Laboratories, Inc., Austin, Texas.
Stass, John George, II, '27 (D). Textile Analyst, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.
Stearns, Kenneth Lawrence, IV, '33 (B.T.C.). 41 Grace Street, Lowell, Mass.
Steele, Everette Vernon, IV, '24 (B.T.C.). Purchasing Agent, Rohm & Haas Co., Inc., Philadelphia, Pa.
Stephens, Arnold George, I, '29 (D). 34 Fremont Street, Somerville, Mass.
Stevens, Dexter, I, '04 (D). Vice-President, Utica & Mohawk Cotton Mills, Inc., Utica, N. Y.
Stevens, Raymond Russell, IV, '19 (B.T.C.). Overseer of Dyeing, The Felters Company, Inc., Millbury, Mass.
Stevenson, Murray Reid, III, '03 (C).
Stewart, Alexander, VI, '31 (B.T.E.). 134 Main Street, Andover, Mass.
Stewart, Arthur Andrew, II, '00 (D). Professor of Textiles; in charge of Finishing Department, Lowell Textile Institute, Lowell, Mass.
Stewart, John Weeden, IV, '30 (B.T.C.). Textile Chemist, General Dyestuff Corporation, 230 Fifth Avenue, New York City.
Stewart, Walter Lawrence, III, '03 (D).
Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Research Work, Rohm & Haas Co., Bristol, Pa.
Stohn, Alexander Charles, III, '06 (C). General Superintendent, Carl Stohn, Inc., Hyde Park, Mass.
Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.
Storer, Francis Everett, II, '07 (D). President, Thames Bank and Trust Co., Norwich, Conn.
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Stott, John Smith, III, '28 (D). 10 Robinson Court, North Andover, Mass.
Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.
Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, Waterbury, Conn.
Sturtevant, Albert William, IV, '17 (D). Automobile Mechanic, Lowell Motor Sales, Inc., Lowell, Mass.
Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist, Better Fabrics Testing Bureau, Room 1010, 461 8th Avenue, New York City.
Suhlke, Waldo Eric, IV, '20 (B.T.C.). Teacher, Jefferson Junior High School, Meriden, Conn.
Sullivan, John David, VI, '12 (D). With Robert Gair Company, Bradford, Mass.
Sullivan, Lambert William, II, '23 (D). With Southwell Wool Combing Company (Silesia Mills), North Chelmsford, Mass.
Sullivan, Willard David, II, '23 (D). 39 Loring Street, Lowell, Mass.
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Sutcliffe, Henry Mundell, II, '25 (D). Overseer, Uxbridge Worsted Company (Granite Mills), Pascoag, R. I.
Sutton, Leslie Emans, I, '17 (D). Superintendent, Anniston Cordage Company, Anniston, Ala.
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Swan, Guy Carleton, II, '06 (D). Chemist in charge, Import Division, United States Department of Agriculture, 201 Varick Street, New York City.
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Sweeney, George Hamilton, II, '24 (D). Salesman, Walker Stetson Company, 157 Essex Street, Boston, Mass.

Swift, Edward Spooner, S. J., I, '02 (D). Clergyman, Church of the Immaculate Conception, Boston, Mass.
Syme, James Francis, II, '00 (D). Industrial Management, 27 Linnaean Street, Cambridge, Mass.
Symmes, Dean Whiting, IV, '22 (B.T.C.) Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

Tamulonis, Edward William, VI, '30 (B.T.E.). Time Study, Newmarket Manufacturing Company, Lowell, Mass.
Tang, Hsiung-Yuan, I, '30 (D). Assistant Manager, Sung Sing Cotton Mill, No. 3, Wusih, Kiangsu, China.
Tarpey, Thomas Joseph, IV, '27 (B.T.C.). Chemist, National Aniline and Chemical Company, Buffalo, N. Y.
Tarshis, Elias Aaron, IV, '28 (B.T.C.). Head Dyer, Pohatcong Hosiery Mills, Washington, N. J.
Teague, Charles Baird, II, '26 (D). Civil Engineer, Highway Division, Massachusetts Public Works Department, Boston, Mass.
Thaxter, Joseph Blake, Jr., II, '12 (D). Vice-President, Ludlow Sales Corporation, 80 Federal Street, Boston, Mass.
Thomas, Roland Vincent, I, '05 (C).
Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc., 829 Providence Road, Charlotte, N. C.
Thompson, Everett Leander, I, '05 (D). Salesman, Tropical Paint and Oil Co., Cleveland, Ohio.
Thompson, Henry James, IV, '00 (D). 15 Greenleaf Street, Malden, Mass.
Todd, Walter Ernest, III, '23 (D). Superintendent, Stanley Woolen Company, Uxbridge, Mass.
Toepler, Carl, IV, '22 (B.T.C.). Chemist, Bellman Brook Bleachery Company, Fairview, N. J.
Toher, Francis Luke, IV, '32 (B.T.C.). 58 Concord Street, Providence, R. I.
Topjian, Leon, IV, '30 (B.T.C.).
Toshach, Reginald Alexander, II, '11 (D). 721 Broadway, Haverhill, Mass.
Toupin, Stephane Frederick, VI, '24 (B.T.E.).
True, William Clifford, II, '22 (D). Industrial Engineer, Chelsea Fibre Mills, Inc., Brooklyn, N. Y.
Turcotte, David Henry, IV, '33 (B.T.C.). 523 Fletcher Street, Lowell, Mass.
Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Medford, Mass.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.
Varnum, Arthur Clayton, II, '06 (D). Superintendent, Troy Blanket Mills, Troy, N. H.
Villa, Luis Jorge, IV, '25 (B.T.C.). Automobile Dealer, Hijos de Vicente, B. Villa & Co., Medellin, Colombia, S. A.
Villa, William Horace, VI, '24 (B.T.E.). Textile Engineer, Compania Colombiana de Tejidos, Medellin, Colombia, S. A.
Villeneuve, Maurice Arthur, II, '26 (D). With Killingly Worsted Mills, Danielson, Conn.
Vincent, William Henry, III, '26 (D).

Walen, Ernest Dean, VI, '14 (B.T.E.). General Manager, Pacific Mills (Worsted Division), Lawrence, Mass.
Walker, Alfred Schuyler, II, '11 (D). 67 Park Avenue, Saranac Lake, N. Y.
Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.
Walker, Raymond Scott, II, '23 (D). Engineer, Wood Mills, Lawrence, Mass.
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Wang, Chen, IV, '23 (B. T. C.).
Wang, Cho, VI, '23 (B.T.E.).

Wang, Tung Chuan, VI, '23 (B.T.E.).

Wang, Yun-Cheng, VI, '31 (B.T.E.).

Wang, Yung Chi, II, '21 (D). Factory Manager, Ching Yuen Silk Mill, Shanghai, China.

Ward, George Chester, IV, '28 (B.T.C.). Research Chemist, Celanese Corporation of America, Cumberland, Md.

Warren, E. Maybelle, IV, '28 (B.T.C.). Chemist, Hub Hosiery Company, Lowell, Mass.

Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

Washburn, John Milton, Jr., IV, '21 (B.T.C.). Sales Promotion Department, New England Laundries, Inc., Somerville, Mass.

Watson, William, III, '11 (D). Real Estate, 50–54 Merrimack Street, Haverhill, Mass.

Webber, Arthur Hammond, IV, '01 (D). Chemist and Colorist, L. B. Southwick & Co., Peabody, Mass.

Webster, Joseph Albert, VI, '23 (B.T.E.). Superintendent, Cloth Division, Aberfoyle Manufacturing Company, Chester, Pa.

Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.

Wells, Ai Edwin, VI, '20 (B.T.E.). Assistant Professor, Mechanical Engineering, Lowell Textile Institute, Lowell, Mass.

Wells, Henry Alfred, Jr., IV, '33 (B.T.C.). Manager, Warwick Print Works, Inc., Bound Brook, N. J.

Westaway, John Chester, VI, '28 (B.T.E.). With W. J. Westaway Co., Ltd., Hamilton, Ont.

Westbrooke, Clayton Collington, IV, '29 (B.T.C.). Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.

Wetherbee, Francis Putney, I, '28 (D). Plant Manager, Flint River Cotton Mills, Albany, Ga.

Wheaton, Walter Francis, VI, '23 (B.T.E.). Owner of Stationery Department, Genung & Leeney, Inc., White Plains, N. Y.

Wheelock, Stanley Herbert, II, '05 (D). President and Treasurer, Stanley Woolen Company, Uxbridge, Mass.

Whitcomb, Roscoe Myron, IV, '10 (D). Pharmacist, R. M. Whitcomb, Ashland, N. H.

White, Royal Phillip, II, '04 (D). Agent, Stirling Mills, Lowell, Mass.

Whitehill, Warren Hall, IV, '12 (D). Textile Chemist, Talbot Mills, North Billerica, Mass.

Wiech, Raymond Edward, IV, '29 (B.T.C.). Assistant Chemist, United Merchants & Manufacturers Management Corporation, 377 Broadway, New York City.

Wightman, William Henry, IV, '06 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.

Wilcox, Leonard Edward, VI, '24 (B.T.E.). With Gofkauf's Stores, Inc., Lowell, Mass.

Williams, Albert William, III, '32 (D). 17 Belle Avenue, Lowell, Mass.

Williamson, Douglas Franklin, I, '22 (D). Superintendent, The Linen Thread Company, Inc., Blue Mountain, Ala.

Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.

Wing, Charles True, III, '02 (D). Paymaster, Merrimack Woolen Corporation, Dracut, Mass.

Wingate, Edward Lawrence, Jr., VI, '28 (B.T.E.). Service Manager, Russell Manufacturing Company, Middletown, Conn.

Wingate, William Henry, IV, '08 (D). Superintendent, Hodges Finishing Company, Dedham, Mass.

Wise, Paul Tower, II, '01 (D). Vice-President, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.

Wojas, Stanley Edward, IV, '33 (B.T.C.). Assistant Chemist, Massachusetts Mohair Plush Company, Lowell, Mass.

Woo, Tsunkwei, VI, '19 (B.T.E.).

Wood, Ernest Hadley, S.B., IV, '11 (D).
Wood, James Carleton, IV, '09 (D). Sales Representative, R. T. Vanderbilt Company, New York City.
Wood, Lawrence Burnham, IV, '17 (B.T.C.). Chemist, Pacific Print Works, Lawrence, Mass.
Woodbury, Kenneth Leroy, VI, '28 (B.T.E.). Cost Finding and Production Engineering, The American Mills Company, New Haven, Conn.
Woodcock, Eugene Close, II, '07 (D). Mill Agent, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.
Woodhead, Joseph Arthur, VI, '23 (B.T.E.). Sales Department, Hess, Goldsmith & Co., Inc., New York City.
Woodies, Ida Alberta, IIIb, '00 (C). See Shananquet, Mrs. Lee.
Woodman, Harry Lincoln, I, '02 (C). Assistant Superintendent, Construction, Merrimac Chemical Company, Woburn, Mass.
Woodruff, Charles Beauregard, I, '06 (C).
Worthen, Clifford Tasker, IV, '22 (B.T.C.). Overseer, Dyeing and Bleaching, McLoughlin Textile Corporation, 203 Park Avenue, Utica, N. Y.
Wotkowicz, Michael Joseph, VI, '20 (B.T.E.).
Wright, Edward, II, '05 (C). Sanitary Engineer, Massachusetts Department of Public Health, 141 State House, Boston, Mass.
Wu, Clarence Wen-Lon, VI, '25 (B.T.E.).
Wu, Tsung-Chieh, VI, '25 (B.T.E.).

Yavner, Harry, II, '12 (D). Merchant, Mayo's Hardware Company, Jamaica Plain, Mass.
Young, Edmund Joseph, Jr., IV, '33 (B.T.C.). Salesman, Puritan Company, Cambridge, Mass.
Yung, E-Zung, I, '32 (D). Personal Secretary to Manager, Sung Sing Cotton Mill No. 3, Wusih, Kiangsu, China.

Zalkind, Benjamin Joseph, VI, '29 (B.T.E.). Textile Engineer, Saco-Lowell Shops, Boston, Mass.
Ziock, LeRoy, II, '25 (D). Agent and Superintendent, Aurora Woolen Mills, Aurora, Ill.
Zisman, Louis Samuel, IV, '20 (B.T.C.). Head of Dyeing Department and Chief Chemist, Gotham Silk Hosiery Company, Inc., 580 First Avenue, New York City.

LOWELL TEXTILE INSTITUTE

APPLICATION FOR ADMISSION

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Name in Full..

Date and Place of Birth..

Home Address ....
City or Town *State*

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Street and Number

INDICATE COURSE DESIRED

DEGREE COURSES

- IV. Chemistry and Textile Coloring
- VI. Textile Engineering
  1. General Course
  2. Cotton Option
  3. Wool Option
  4. Design Option
  5. Sales Option

DIPLOMA COURSES

- I. Cotton Manufacturing
- II. Wool Manufacturing
- III. Textile Design

Graduate of..........................High School, Year 193......

Other High or Preparatory Schools attended.......................

If you have done collegiate work, give name and address of college or university ....193...—193...

Signature ....

Signatures of..

Parents or Guardian..

Citizen of ....
City or Town *State*

SERIES 37, No. 4 May, 1934

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A STUDY OF THE CAUSE OF THE NUMBER OF OPERATIONS USED IN WORSTED DRAWING.

By JOHN C. LOWE, B.T.E., Assistant Professor of Textiles

The object of this paper is to present the nature, extent, and results of two theses which have been prepared under the direction of Professor Herbert J. Ball, in charge of the Textile Engineering Department. The material for Experiment 1 is selected from the undergraduate thesis by E. L. Wingate, B.T.E. 1928, and that for Experiment 2 is from the undergraduate thesis by John C. Lowe, B.T.E. 1934. Both theses were a partial requirement for the degree of Bachelor of Textile Engineering.

The purpose of both theses was to investigate the influence which an increase in the weight of the end after the Noble comb has upon the number of operations necessary to produce roving from comb sliver.

The theory involved is outlined in three considerations:

(1) Increasing the size of the end after it leaves the Noble comb increases the effective draft necessary to obtain the required reduction of the top to roving.

(2) The effective draft controls the number of doublings necessary to maintain evenness. Fewer doublings are required when the effective draft is reduced.

(3) The number of operations required to produce a satisfactory roving is governed by the effective draft necessary to obtain the required reduction from top to roving.

Effective draft is that part of the draft which causes the reduction in the size of the end delivered as compared to the size of the end entering the machine. Draft is not effective when its action upon reduction is neutralized by doublings.

Draft applied in successive operations to a single end will produce unevenness. It will be found that, in general, using no doublings approximately three operations will be required to reduce top to roving. This suggests that all operations exceeding three are made necessary by the doublings used to maintain evenness. It follows that if a lighter ounce top were used the total reduction, from top to roving, would be lessened, unevenness due to drafting would be reduced, and, therefore, fewer operations would be necessary to produce roving from it. The maximum benefit should be obtained when an increase in the weight of the end from the Noble comb is avoided in any of the following operations.

To test the theory, two 2/32 yarns were processed in Experiment 1 from ½ blood wool, and in Experiment 2 three 2/36 yarns were processed from ⅜s blood recarded waste. The stock used in Experiment 1 was obtained from a mill in the form of Noble comb sliver, and came from four combs.

Figure 1 presents a comparison of the three routines followed for Yarns 1, 2, and 3 in Experiment 2. Routine 1 with the additional operation of fine drawing following the weigh box, and Routine 3 were used for Yarns 1 and 3, respectively, in Experiment 1.

Figure 2 shows graphically the changes in the weight of the end throughout each routine of Experiment 2. Plots A and B also fairly represent similar changes for Yarns 1 and 3 in Experiment 1, respectively. The horizontal line D, representing the weight of the end from the comb, intersects Plots A and C, indicating that for Yarn 1 six operations have been used before an actual reduction in weight is obtained. Thus practice considers that these six operations, with an enormous number of doublings, are required to make the end from the Noble comb fit to be reduced to roving, with nothing accomplished beyond blending, and evening.

These yarns were woven into cloth, and finished, care being taken to avoid any variations in processing so that any differences revealed in subsequent tests would be due to the different yarn routines only.

To measure the physical properties the ply yarns were tested for yarn number or counts, turns per inch, breaking strength, both single strand and skein, and elongation. The fabrics were tested for breaking strength, using the strip test for Experiment 1 and the grab test for Experiment 2. The weight per square yard, the weight per linear yard, and the ends and the picks per inch were also determined.

All tests were made under atmospheric conditions of 65% R.H. and temperatures ranging between 70° to 79.5° F., and after exposure of the samples for at least four hours to the same atmosphere.

Due to differences existing in yarn number, and turns per inch, the actual strength test results could not be fairly compared. Within small limits the strength of a yarn varies indirectly as the count, and directly as the turns per inch. The same is also true for the strength of a fabric with the additional variable of ends per inch — warp and filling.

To obtain comparison factors (C.F.) two conversion formulas were used:

$$(1)\quad \frac{\text{Mean breaking strength x Mean yarn no.}}{\text{Mean turns}} = \text{C. F. for yarns}$$

$$(2)\quad \frac{\text{Mean breaking strength x Mean yarn no.}}{\text{Mean turns x Mean ends per tested width}} = \text{C. F. for fabrics}$$

For reference, a Summary is presented on Page 4 which contains most of the important data and lists the actual results of tests, which may thus be compared where necessary with the comparison factor ratios.

Comparison charts, Figures 3 and 4, are constructed from comparison factors for strength tests of both yarns and fabrics, and from actual results for elongation. To facilitate comparisons, it is to be noted that for all strength and elongation tests Routine 1 or Yarn 1 equals 100, and for comparison of the submean to the mean, the mean equals 100.

In addition to the physical tests, both yarns and fabrics were examined by many mill executives. Their opinions follow.

Yarns: Exp. 1 — There is very little difference if any between the two yarns in evenness. Yarn 3 is preferred for its elasticity.

Exp. 2 — The consensus of opinion favored Yarn 3 as being the most even and most elastic. A few preferred Yarn 2, but none selected Yarn 1 as being the best.

Fabrics: Exp. 1 — The advantage is with Fabric 3 which has a better handle than Fabric 1. There is no choice as regards the general evenness.

Exp. 2 — Decision was difficult. Fabric 1 was eliminated in the grey and finally Fabric 3 was selected as the best with Fabric 2 very close. For the finished fabrics there was not a unanimous opinion, except on one point, namely, that both Fabrics 2 and 3 are superior in elasticity.

The deductions to be made both from the actual examinations and the results of the comparative studies are as follows:

(1) Excessive processing seems to affect the physical properties of the fibre thus reducing both the strength and elasticity of the yarn, for in both experiments the ordinary yarn is inferior both in strength and elasticity.

(2) The superiority in strength of Yarn 2 over that of Yarn 3 in Experiment 2 is wholly due to (a) the use of one intersecting gilling process instead of two ordinary gill boxes, and (b) the increase in the weight of the end after it left the Noble comb for Yarn 3. Therefore intelligent use of the intersecting gill box should lead to a reduction in the number of operations required to reduce top to roving for any system of worsted drawing.

(3) Both experiments support the soundness of the theory that an avoidance of an increase in the weight of the end after it leaves the Noble comb would reduce the number of operations necessary to produce a satisfactory yarn, for in neither yarn nor fabric are the yarns processed by Routine 1 — ordinary procedure— superior to the yarns produced by Routines 2 and 3.

SUMMARY

	Experiment No. 1		Experiment No. 2		
YARN DATA	#1	#3	#1	#2	#3
Total doublings	576,000	2304	1,198,080	1536	6912
Ratio of doublings	250	1	780	1	4.5
Total operations	11	7	10	6	7
Effective draft	186	58	165	40	80
Total draft	63,600,000	84,520	45,980,000	57,400	279,936
Mean yarn number	2/31.5	2/31.7	2/34.6	2/36.2	2/34.3
Mean turns per inch	12.3	12.0	13.2	12.1	13.2
Single strand tests — ply					
Mean breaking strength — grams	353	356	232	237	248
Mean elongation — %	13.5	13.9	10.8	11.7	11.6
Skein tests — ply					
Mean breaking strength — lbs.	105.9	107.2	95.0	90.0	95.1
FABRIC DATA	Strip Tests		Grab Tests		
Ounces per square yard	5.41	5.16	7.82	7.85	8.4
Ounces per yard — 54″ wide	8.12	7.74	11.73	11.78	12.6
Mean breaking strength — lbs.					
Grey — warp	41.2	41.4	121.3	119.5	129.2
Grey — filling	34.4	34.8	54.8	61.5	59.0
Finished — warp	48.6	48.0	102.1	101.2	109.6
Finished — filling	32.8	33.4	40.6	40.0	41.8
COMPARISON FACTOR RATIOS					
Single strand breaking strength	1.00	1.04	1.00	1.16	1.06
Skein breaking strength	1.00	1.05	1.00	1.08	0.99
Grey — warp breaking strength	1.00	1.06	1.00	1.12	1.08
Grey — filling breaking strength	1.00	1.05	1.00	1.12	1.06
Finished — warp brk. str.	1.00	0.99	1.00	1.13	1.05
Finished — filling brk. str.	1.00	1.05	1.00	1.07	1.04

OPERATIONS USED IN YARN MANUFACTURE

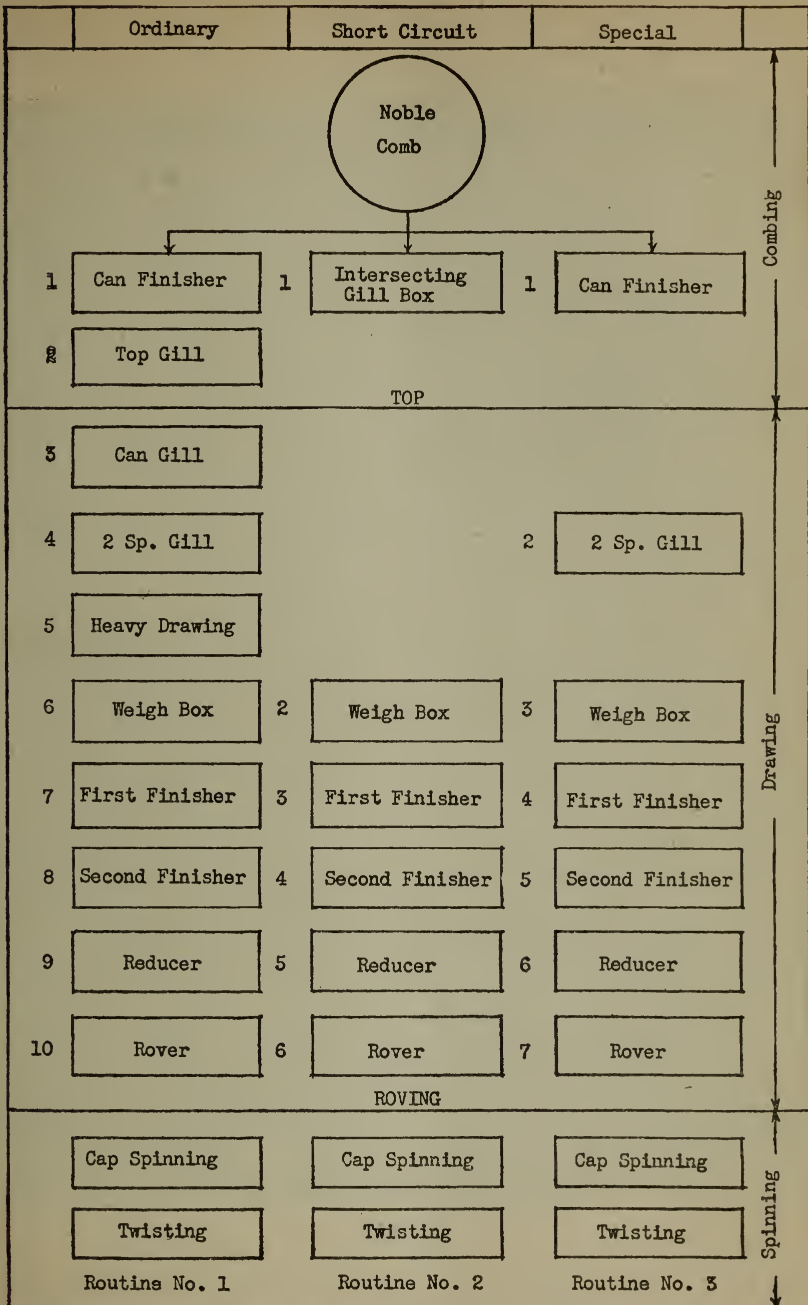

Figure 1

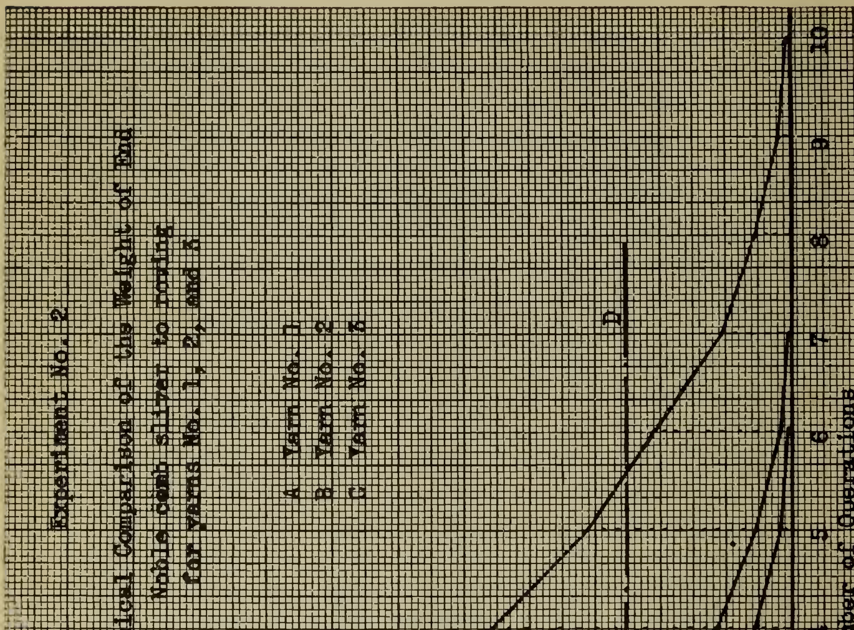
Experiment No. 2
Graphical Comparison of the Weight of End
Noble comb sliver to roving
Number of Operations

Figure 2

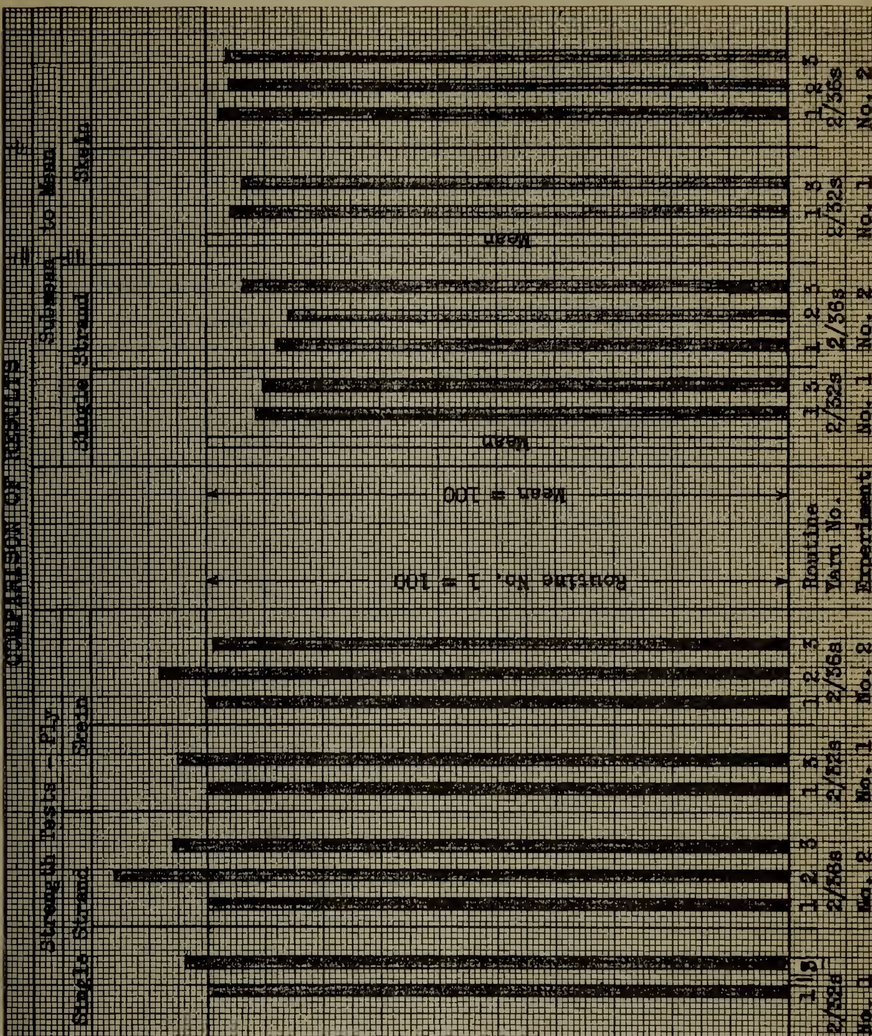
COMPARISON OF RESULTS
Strength Tests - Ply
Subsamples to Mean
Single Strand
Skein
Mean
Mean = 100
Routine No. 1 = 100
Routine
Yarn No.
Experiment
2/32s
2/36s
No. 1
No. 2

Figure 3

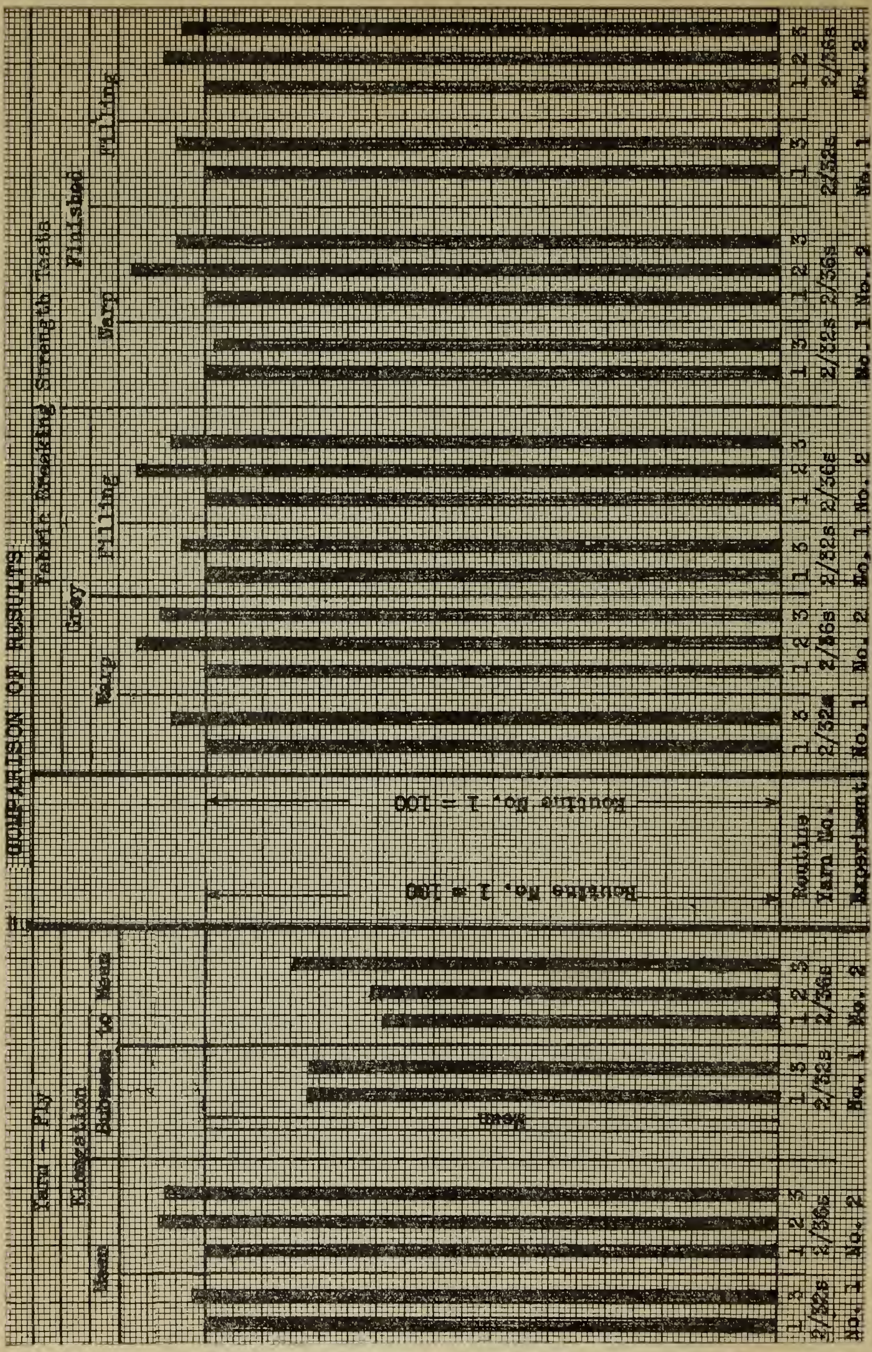
COMPARISON OF RESULTS
Yarn - Ply
Mean
Elongation
Fabric Breaking Strength Tests
Grey
Finished
Warp
Filling
Routine No. 1 = 100
Routine
Yarn No.
Experiment
2/32s
2/36s
No. 1
No. 2

Figure 4

SERIES 38. NO. 1. August, 1934

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1934-1935

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Moody Street and Colonial Avenue

DEPARTMENT
OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document approved by the Commission on Administration and Finance
2M. 7-'34. Order 1903.

LOWELL EVENING TEXTILE SCHOOL.

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1934.

September 27, Thursday	Registration.
October 4, Thursday	Registration
October 8, Monday	Opening of evening school.
October 12, Friday	Columbus Day—Holiday.
November 12, Monday	Holiday—Observance of Armistice Day.
November 29, Thursday November 30, Friday	Thanksgiving recess. No classes.
December 21, Friday	End of first term.

1935.

January 3, Thursday	Opening of second term.
February 22, Friday	Washington's Birthday—Holiday.
March 8, Friday	Closing of evening school
April 9, Tuesday	Graduation.

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Assistant Instructor in Chemistry.	
PAUL DAVID PETTERSON	East Chelmsford.
Assistant Instructor in Machine Shop Practice.	
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Assistant Instructor in Chemistry.	
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MONA BLANCHE PALMER	685 Westford Street.
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Clerk.	
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HAROLD ARTHUR GIFFIN	785 Stevens Street.
Evening Instructor in Design.	
HENRY EARL McGOWAN, B.T.E.	36 Varney Street.
Evening Instructor in Mathematics.	
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Evening Instructor in Electricity.	
EDWARD W. DOOLEY	799 Chelmsford Street.
Evening Instructor in Advertising Design.	
VITTORIA ROSATTO	63 Bradstreet Avenue.
Evening Instructor in Art.	
J. RAYMOND BRADLEY	29 Paige Street.
Evening Instructor in Advertising Design.	
JAMES C. BUZZELL	26 Princeton Boulevard.
Evening Instructor in Electricity.	
GLEN BOWDEN CASWELL, ...	32 Hampshire Street.
Evening Instructor in Machine Shop.	
BERTHA C. HOELLRICH	30 Saxonia Avenue, Lawrence.
Evening Instructor in Art.	
GATENBY, FREDERICK WILLIAM	Forge Village
Evening Instructor in Worsted Yarns.	
EMMONS, ARLENE	755 Westford Street.
Evening Instructor in Art.	

EVENING CLASSES

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the second Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

110. Cotton Yarns—2 Years.

Because of the desire of students to be able to complete the course in Cotton Yarns in less than three years, the schedule has been rearranged to complete the work in two years. If a sufficient demand develops for additional work, it may be possible to add a course on Mill Organization which will follow the course in Cotton Yarns.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used and the production of each process as well as the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the control of waste.

Two evenings each week.

Cotton.—Before taking up the details of manufacturing cotton into yarn, a careful study of its physical characteristics is made. The geographical distribution of the areas producing commercial cottons is explained and the characteristics of the cottons produced in each are studied. A general explanation of the cultivation and harvesting of cotton is made, especially emphasizing the effect of agricultural factors on the cotton fiber and how these may serve to complicate manufacturing problems.

The ginning of cotton is considered, showing the yield of lint, the uses of cotton seed and the various types of gins and which cottons are commonly ginned on each.

The intricate system of buying and selling cotton is studied to illustrate the problems a mill may meet in procuring cotton. In this connection, special emphasis is placed on the classification of cottons by staple, grade and character.

Opening and Picking.—Instruction in the preliminary operation of opening and picking covers the mechanical construction of the machines, their parts and adjustments, as fully as the manufacturing results accomplished by the machines. This includes such construction details as evener, lap measuring and safety stop motions, grids, cleaning trunks and beaters, also operation details which involve the adjustment for waste, drafts and character of laps. Some time is devoted to mixing in its various phases, showing in addition to improvement in uniformity of the product, how cottons are mixed to obtain definite average prices and how different percentages of color may be obtained by mixing, expecially on the pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, spooling, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper attention is paid to such subjects as stop motions, drawing rolls and their covering, clearers and evener motions.

Roving Process.—Under this head are studied the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use.

Ring Spinning.—The consideration of spinning yarn by the ring frame method involves a knowledge of the uses to which the yarn is to be put and subsequent methods of handling, that proper roving may be selected, suitable amounts of draft and twist provided, correct size of rings and travelers selected, and building motions suitably adjusted. Yarn defects are studied with reference to the cause and remedy, necessitating references to many of the earlier operations.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns is taken up here. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

WOOLEN AND WORSTED DEPARTMENT.

210. Worsted Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc., also a course in carding and the calculations involved in the mechanism of the machines, and a course covering gilling and combing and the processes of top making.

Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk,

mohair, alpaca, vicuna, cashmere, camel's hair and cotton. In connection with these are considered shoddy, noils and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture. The various characteristics and properties are explained, as are also trade terms, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of soaps and chemicals used in washing; also the waste products and their utilization. A demonstration of a commercial quantity of wool is scoured by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap. At the same time the use of driers, their operation and regulation, is taken up, and the methods of carbonizing wool, noils, burr waste, rags, etc., are studied and explained.

Carding.—The different systems of carding wool, depending on whether it is to be made into woolen or worsted yarns, are fully explained, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application and grinding.

Top Making and Combing.—This branch takes up, besides the carding of the wool on a worsted card, the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures. Later, quantities of stock are made into top and then into yarn.

Three evenings each week.

The *second year* is devoted to detail study of the English and French systems of worsted yarn manufacture.

The Noble, Lister and French combs are studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

211. Woolen Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc.

One evening each week.

The *second year* covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Two evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Com-

bination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in

the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

314. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

One evening each week.

315. Woolen and Worsted Weaving—2 Years.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

One evening each week.

316. Dobby and Jacquard Weaving—1 Year.

This course considers the various types of Jacquard heads and dobbies, which includes single cross border dobbies and leno attachments on double lift dobbies, handkerchief motions, leno weaving, center selvedge motions, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving. The course on Jacquard looms includes general construction, card cutting, lacing, repeating and fixing.

One evening each week.

317. Art Course—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

318. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Talbot's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, cloth and other materials of particular interest to the textile chemist, special lecture notes and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT

510. English Composition—2 Years.

Remedial English and Rhetoric—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

Problems in the Interpretation and the Appreciation of Literature—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

For one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint, the course in Mechanical Drawing is offered. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

This course is a complete course in drawing and requires *two evenings per week* for three years for its completion. The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete. The time required is *two evenings each week*.

619. Mechanics and Mechanism—2 Years.

This is one of the most important of engineering subjects dealing as it does with the principles which underlie the transmission of force and motion through machines and mechanical devices. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion and the course concludes with a study of pulleys, belting, gears and gearing, as far as time permits. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires attendance *two evenings each week* with home problem work and the study of a text book.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further by evening study the mathematics of his grammar or junior high school course. It includes algebra, elementary trigonometry, logarithms and slide rule, and requires attendance for *two evenings each week*. It should be taken by all who intend to study further into engineering subjects. Instruction is largely through problem work in class and at home, and the use of a text book.

Some of the topics treated are—

Elementary algebraic operations of—

- Addition.
- Subtraction.
- Multiplication.
- Division.
- Factoring.
- Fractions.
- Graphical representation.
- Linear equations.
- Radicals.
- Quadratic equations.
- Logarithms.
- Slide rule.
- Trigonometry.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The time required is *two evenings each week* and the method of instruction is through lectures, recitations, problems, and the use of a text book.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used, requiring an attendance of *two evenings each week*.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. It requires for its completion attendance for *two evenings each week* and a considerable amount of home study and preparation. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work. An attendance of *two evenings each week* is required.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated.

A test book is required and the class is held *two evenings each week*.

626. Mill Illumination—1 Year.

Because of the demand by mill men, this course is now offered to evening students and requires an attendance of *two evenings each week.*

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

627. Textile Marketing—1 Year.

An elementary course designed to acquaint the student with the principles of selling and merchandising of textiles.

The selling agent, broker, converter, wholesaler, merchant, factor, and other intermediaries in the channels of distribution are studied as well as the fundamentals of salesmanship, advertising, styling, market research, pricing, retailing, wholesaling, and forecasting.

The material is presented by means of lectures and class discussions on assigned problems. An attendance of *two evenings each week* is required.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In these courses machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. These courses also help the finisher to broaden his knowledge of textile fabrics. Attendance is required for *two evenings each week.*

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali

and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

711. Cotton Finishing—1 Year.

The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the objects thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all

types, and for various purposes; the use of cooling tanks, steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing; the use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustment of various types.

Water Mangles.—Their object and construction of various types; various rolls,—iron, husk, etc., scutchers, their object and construction.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls,—brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical, tenter frames, clips; the swing motion and the finishes thus produced; construction; spraying machines, belt stretchers, button breakers; their object and construction.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk and paper; the use of hot and cold rolls; chasing, friction, embossing and Shriner calenders and the various finishes produced by each; production of watered effects; beetling machines.

Making up room,—yarding, inspecting; different types of folds; pressing, papering, marking.

Two evenings each week.

EVENING GRADUATES OF 1934.

Certificates awarded as follows, April 10, 1934:

Cotton Yarns—3 Years.

Harold Anderson	Arlington
Harry Gustaf Hjerpe	Quincy

Worsted Yarns—2 Years.

Joseph Linwood Allen, Jr.	Lawrence
Leslie Newell Center	Wilton, N. H.
John Christison	Methuen
Joseph Leo FitzGerald	Milford, N. H.

Woolen Yarns—2 Years.

Harry Lawrence Edwards	Lowell
William Edward Laskey	Dracut
Herbert Hodgson Robinson	Methuen

Cotton Design—3 Years.

Leo Napoleon Cyr	Lowell
Lucien R. Dupuis	Lowell
John Janas	Lowell

Woolen and Worsted Design—3 Years.

David Alexander Stirling Doig	Andover
Benjamin Kalinowski	North Andover
James Venn	Forge Village

Freehand Drawing—3 Years.

Albert Milton Anderson	Lowell
Mary Blanche Bouffard	Lowell
Gabrielle Alice Clermont	Lowell
Albert Charles Cormier	Lowell
William Edward Hurrell	Lawrence
Loyola Rita Kiernan	Dracut
Delia Moses	Lowell
Katherine Arlene Redmond	Lowell
Rita Theresa Sullivan	Lowell

Show Card Design—2 Years.

George John Chrisostomedes	Dracut
Irene Elizabeth DeLorme	Lowell
George Stuart Dickison	Lowell
Ivar Eric Gustafson	Lowell
Maurice Joseph Inamorati	Lowell
Dora May Laflamme	Lowell
Omer Lafontaine	Dracut
Anna Esther McErlane	Lowell
Clifford Garner Marsden	Lowell
Simon Harry Moreau, Jr.	Lowell

Cotton Weaving—1 Year.

Harold Anderson	Arlington
Chester Arthur Brown	Lowell
David Mungall Brown	Lawrence
Harry Robert Buckley	Lawrence
Robert Theodore Charlton, Jr.	Lowell
Leander Forest Conley	Dracut
Frank Cunha	Lowell
Leo Walter Fitzgerald	Lowell
Norman Garlington	Lawrence
Melvin Reade Hall	Lawrence
Harry Gustaf Hjerpe	Quincy
Patrick Joseph Keegan	Lowell
Harold Norman Logan	Lowell
Fred Dean Manchester	Lowell
Lionel Thiophile Pelletier	Lowell
Kenneth Lawrence Stearns	Lowell
Thomas Fletcher Thomson	Lowell
Lionel Donat Turcotte	Lowell

Woolen and Worsted Weaving—2 Years.

Philip Schubert Benoit	Methuen
James Bernard Cousen	Lawrence
Clement Freyre	Lawrence
Harry Augustine Matthes, Jr.	Lawrence
Walter Edward Witalis	Lowell

Dobby and Jacquard Weaving—1 Year.

Lionel Thiophile Pelletier	Lowell

Loom Fixing—1 Year.

Chester Arthur Brown	Lowell
Charles Eugene Dube	Lawrence
Graham Allard Giffin	Lowell
Ralph William Giffin	Lowell
Fred Dean Manchester	Lowell
Fred Joseph Starke	Methuen

Woolen and Worsted Finishing—1 Year.

George Whitehouse Arthur	Methuen
Walter Samuel Bean, Jr.	Lowell
Peter Borrows, Jr.	Chelmsford
Thomas Bruce	Methuen
Russell Wade Clarke	Lowell
Stanley Joseph Dziadosz	Lawrence
Luis Echavarria	Lowell
Robert Augustine Girard	Lawrence
William Samuel Heffernan	Methuen
Thomas Francis Killilea	Lawrence
Arthur Francis Kittredge, Jr.	Melrose
John Henry Lorigan	Lowell
Joseph Miller, Jr.	Lowell
John Bernard Murphy	Lowell
Ernest Dobson Robinson	Methuen

Elementary Chemistry—2 Years.

Norman Ashton	Methuen
Peter John Bandis	Lowell
Harold Francis Bradley	Lawrence
Alfred Calabrese	East Boston
Robert Martin Chenevert	Lowell
Aristophanes Demetrius Gatzimos	Lowell
Nelson Fletcher Getchell	Lowell
Paul Roland Giroux	Lowell
Otis Caton Gorman	Nashua, N. H.
Lawrence Paul Hartigan	Lowell
Raymond Lucien Hebert	Lawrence
Raymond Louis Huard	Haverhill
Ralph Irving Kenyon	Methuen
Douglas Ormiston Lees	West Medford
George Augustine Molloy	Lawrence
Frank Lewis Orrell, Jr.	Lowell
William Alexander Page	Andover
Carleton Prescott	Lawrence
Joseph Edward Reidy	Lowell
Harry Richardson	Lawrence
Edward Wallace Rutyna	Lowell
Clifton Charles Timms	Methuen
William Murray Urquhart	Andover
Raymond Widdop Wood	Lawrence

Textile Chemistry and Dyeing—3 Years.

John Bernard Moran	Methuen
Earl Whitney Pulsifer	Nashua, N. H.

Analytical Chemistry—3 Years.

Dumont Rudolph Vigneault	Lowell
Wilbur Lane Williams	Lowell

Textile and Analytical Chemistry—4 Years.

William Aloysius Kulpinski	Lawrence
Raymond William Schernig	Lawrence

Mechanical Drawing—3 Years.

James Badger	Nashua, N. H.
John Corriera, Jr.	Lowell
Leo Jerome Perry	Lawrence
Dore Earle Tyler	Lowell

Machine Shop Practice—2 Years.

Wilfred Bottomley	North Andover
James John Manikas	Lowell
Michael William Schofield	Lawrence

Mathematics—2 Years.

Margaret Kennedy Burns	Lowell
Thomas Francis Carden	Lowell
Caroline Mary DeNicola	Lowell
Mary Louise Donohoe	Lowell
James Edward Driscoll	Methuen
Lionel Ducharme	Lowell
Theodore Kapala	Lowell
Bernard Frank Lawson	Lawrence
Donald McKeown	North Billerica
Claire Anna Quigley	Lowell
Stanley Waclaw Rasimowicz	Lowell

Steam—1 Year.

Frank Milton Campbell	Clinton
Frank Matheson Stebbings	Lawrence
Stephen Patrick Tobin, Jr.	Lowell
Randolph Carter Wills	Lowell

Textile Marketing—1 Year.

Wilfred Leo Beauregard, Jr.	Lowell
Hyman Bebchick	Lowell
Francis Patrick Callahan	Lowell
Joseph Benedict Gallagher	Lowell
Andre Henry Gervais	Lowell
Calman Hoffman	Lowell
Douglas Arthur Seed	Salem, N. H.
Charles William Simpson	Lowell
Claude Alfred Taylor	Methuen

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2200. 12-'34. Order 3118.

THE LUBRICATING POWER OF OILS ON WOOL FIBERS

By John H. Skinkle, S.B.,

Instructor, Chemistry and Textile Coloring Department

Assisted by Roland C. Morrison, B.T.C.

The use of oils on scoured wool preparatory to the mechanical processes is in general use in the industry for the purpose of reducing the clinging power of the fibers for each other to the point where impurities and short fibers may be removed easily from the longer fibers. Most of the data on the use of oils for wool fiber lubrication is concerned with the ease of removal of the oil and the tendency of the oil to become rancid, and little or no work has been done on the effects of the oils on the lubrication of the fibers. It is generally supposed that olive oil is superior to other oils for this purpose, but that mineral oil would be satisfactory provided that it could be easily removed afterward; therefore the first work was done in the form of a comparison of olive oil and mineral oil.

For mechanical reasons, the measurement of the coefficient of friction of fiber on fiber was impracticable so it was decided to measure the coefficient of friction of fibers on glass, glass being selected as being most easily reproducible. The apparatus used was a modification of that described by Mercier* and used by him to measure the coefficient of friction of fabrics. A simple relationship exists between the angle of slide of a material and its coefficient of friction.

Let μ = coefficient of friction
Let F = frictional resistance acting on a block
Let N = force normal to the surface
Let W = weight of the block
Let A = angle of the inclined plane

If we assume that a block is resting on an inclined plane so that it is just on the point of starting to slide, then the frictional resistance of the block is just equal to a moment of the gravitational force parallel to the surface of the plane and

$$F = W \sin A$$

The force normal to the surface of the plane is

$$N = W \cos A$$

By definition, $\mu = F/N$

Therefore,

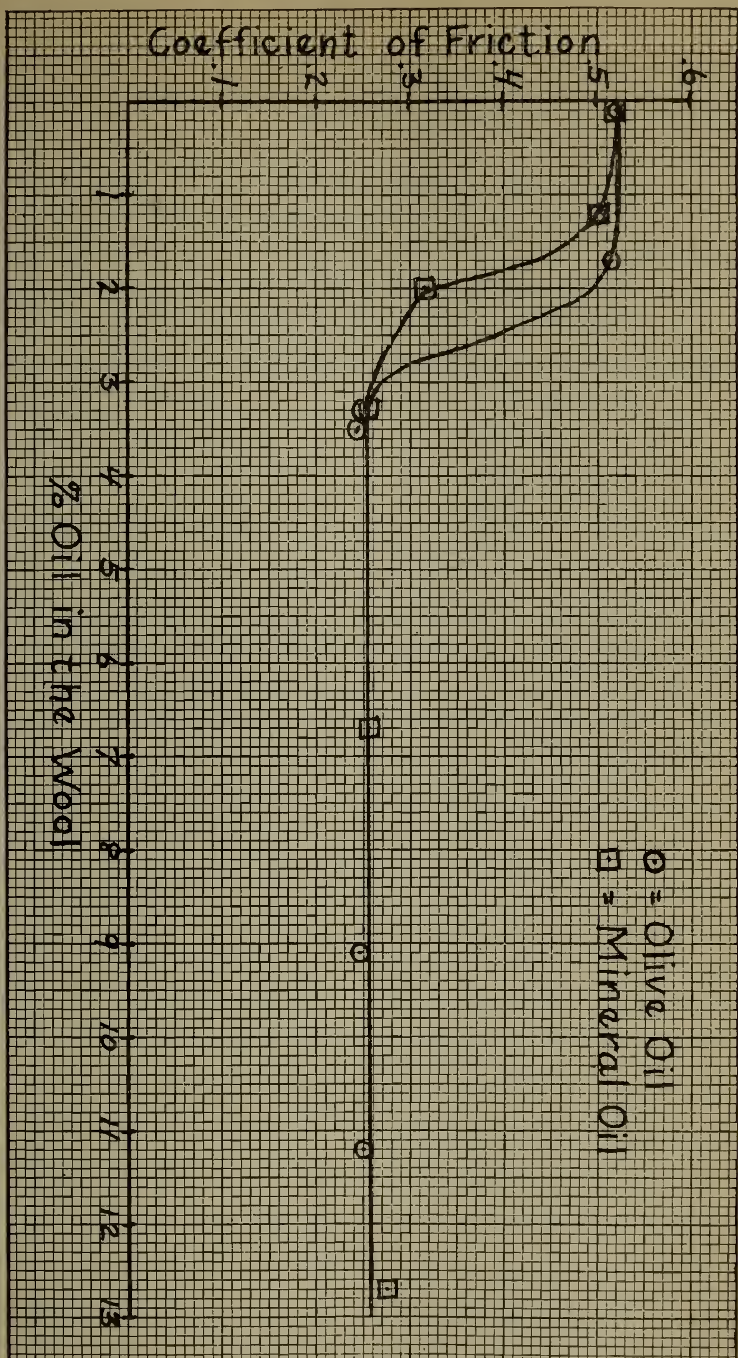
$$\mu = \frac{F}{N} = \frac{W \sin A}{W \cos A} = \tan A$$

The apparatus consists of a baseboard which may be leveled, and hinged to it at one end is a board with an inset piece of glass to serve as the inclined plane. The angle of the plane was varied by moving a block of steel machined to exactly two inches in height along guides lengthwise of the baseboard. The tangent of the angle (or coefficient of friction) was then obtained by dividing 2.000 inches by the distance from the point of swing to the base of the steel block. The fibers in the form of tops were held lengthwise of a wooden block and covering the bottom of the block.

The block and fibers were placed on the inclined plane and the angle increased to the point where, with the assistance of light tappings, the block commenced to slide. The angle was then lowered slightly and the process repeated. After each determination, the glass plate was cleaned off with a volatile solvent.

A sample of wool top large enough to give all the samples necessary was obtained from the Wool Department and extracted with gasoline until less than 0.1% oil was left. Fractions of this top were then soaked in solutions of the oils in petroleum ether of such strength as to give a series of values for each oil.

* "American Wool and Cotton Reporter," November 13, 1930.


Coefficient of Friction
.1
.2
.3
.4
.5
.6
% Oil in the Wool
1
2
3
4
5
6
7
8
9
10
11
12
13
⊙ = Olive Oil
⊡ = Mineral Oil

Preliminary work showed that check results could not be obtained from the first slide of the block, presumably because a thin film of oil was then deposited on the glass.

After the determination of the coefficient of friction of each sample of wool, the amount of oil present was determined by an extraction in the Soxhlet apparatus.

The oils used were of the following properties:

OLIVE OIL:

Specific gravity = 0.914 at 60° F.
Viscosity = 204 Saybolt seconds at 100° F.

MINERAL OIL:

Specific gravity = 0.895 at 60° F.
Viscosity = 243 Saybolt seconds at 100° F.

The following data were obtained and plotted in the accompanying graph:

OLIVE OIL		MINERAL OIL	
% oil in wool	Coefficient of friction	% oil in wool	Coefficient of friction
0.1	0.520	0.1	0.520
1.7	0.513	1.2	0.500
3.3	0.247	2.0	0.315
3.5	0.242	3.3	0.256
9.1	0.247	6.7	0.255
11.2	0.250	12.7	0.276

CONCLUSIONS

1. Practically identical results are obtained for both oils above three per cent.
2. Below a concentration of three per cent, mineral oil is superior to olive oil in lubricating efficiency.
3. There is no advantage, from the standpoint of lubrication, in adding more than 3–4% of either oil. This concentration is apparently enough to give a continuous coating to the fibers.

Southwick Hall

SERIES 38, NO. 3. *February, 1935*

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1935

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Moody Street and Colonial Avenue

Publication of this Document approved by the Commission on Administration and Finance

6100. 2-'35. Order 3614.

CALENDAR

1934–1935

September 13–14, Thursday–Friday	Entrance Examinations
September 17–22, Monday–Saturday	Re-examinations
September 20, Thursday, 9.00 A.M.	Registration for Freshmen
September 24, Monday	Registration for upper-class students Classes begin for Freshmen
September 25, Tuesday	Classes begin for upper-class students
October 12, Friday	Columbus Day — Holiday
November 12, Monday	Holiday — Observance of Armistice Day
November 27, Tuesday, 4.45 P.M.	Thanksgiving recess begins
December 3, Monday, 9.00 A.M.	Thanksgiving recess ends
December 21, Friday, 4.45 P.M.	Christmas recess begins
January 2, Wednesday, 9.00 A.M.	Christmas recess ends
January 14, Monday	First term examinations begin
January 25, Friday	End of first term
January 28, Monday	Second term begins
February 22, Friday	Washington's Birthday — Holiday
April 12, Friday, 4.45 P.M.	Spring recess begins
April 22, Monday, 9.00 A.M.	Spring recess ends
May 20, Monday	Second term examinations begin
May 30, Thursday	Memorial Day — Holiday
June 4, Tuesday	Commencement
June 6–7, Thursday–Friday	Entrance Examinations

1935–1936

September 12–13, Thursday–Friday	Entrance Examinations
September 16–21, Monday–Saturday	Re-examinations
September 19, Thursday, 9.00 A.M.	Registration for Freshmen
September 23, Monday	Registration for upper-class students Classes begin for Freshmen
September 24, Tuesday	Classes begin for upper-class students
November 11, Monday	Armistice Day — Holiday
November 26, Tuesday, 4.45 P.M.	Thanksgiving recess begins
December 2, Monday, 9.00 A.M.	Thanksgiving recess ends
December 20, Friday, 4.45 P.M.	Christmas recess begins
January 2, Thursday, 9.00 A.M.	Christmas recess ends
January 13, Monday	First term examinations begin
January 24, Friday	End of first term
January 27, Monday	Second term begins
April 3, Friday, 4.45 P.M.	Spring recess begins
April 13, Monday, 9.00 A.M.	Spring recess ends
April 20, Monday	Holiday — Observance of Patriots' Day
May 18, Monday	Second-term examinations begin
May 30, Saturday	Memorial Day — Holiday
June 2, Tuesday	Commencement
June 4–5, Thursday–Friday	Entrance Examinations

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HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because

of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn: The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had in charge the work of construction. The building completes the fourth side of the quadrangle, and in outward appearance corresponds to the architectural features of the other school buildings. It is a single-story building, and has the dimensions of 195 by 60 feet. Its interior is faced with cement brick made at the school during the progress of the work. These serve to give light-reflecting walls which are advantageous for the work of the Wool Manufacturing, Cotton Finishing and Chemistry and Dyeing

Departments that occupy this building. The funds for this building were provided by the State of Massachusetts.

The buildings are of modern mill construction adapted to educational uses and contain approximately 180,563 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus. Chest weights, wooden dumb-bells, Indian clubs, a set of traveling rings, a vaulting horse, parallel bars, a punching bag and several sets of foils and single sticks have been provided.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	11

Elective Subjects	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make ten points and present certificates showing satisfactory courses in such of the elective subjects to make three additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of twelve points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	9

Elective Subjects

Three may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 6, 1935; Thursday, September 12, 1935; Thursday, June 4, 1936:—
Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 7, 1935; Friday, September 13, 1935; Friday, June 5, 1936:—
Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subject scheduled in the regular course will, upon presentation of acceptable certificate be given credit for such work.

GRADUATE COURSES

By Act of the Legislature of 1935 this Institute may grant the degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering. A student must hold a Bachelor's degree to be eligible for these courses. In general it will require one-year's resident work for graduates of this Institute and two-years' work for applicants from other institutions. The courses required will depend upon the preparation of the student.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be succcessul in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 19, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction from the mark obtained in the course in which the absences occurred will be made.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians of all students under age, and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—For all first-year students a minimum deposit of $25 is required to cover the cost of breakage, supplies, apparatus and chemicals used in the Chemical Laboratory, the unexpended balance to be returned to the student at the end of the year. For all students in second, third, and fourth years taking work in Chemistry and Dyeing Laboratories a deposit of $25 for the first term and $25 for the second term is required.

Students taking Machine Shop will be required to make deposit of $15 to cover cost of materials, supplies and breakage. Included in this charge is a kit of tools which is essential to the work and which becomes the personal property of the student. The unexpended balance will be returned at the end of the year.

Students not taking Chemistry Laboratory or Machine Shop will be required to make a deposit of $10 each year to cover general breakage. The unexpended balance will be returned at the end of the year.

All deposits must be made before students can be admitted for laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if

mounted, and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	15
General breakage fee	10
(This applies to students who do not take chemistry or machine shop.)	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

SCHOLARSHIPS AND PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives annually a theatrical program at the Lowell Auditorium. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—A Student Section of the American Society of Mechanical Engineers holds meetings regularly in accordance with requirements of the national organization. The Student Section of the American Society of Dyers and Colorists holds meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. — A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1934–35

Harry F. Finlay, '10, *President*
Harry W Martin, '11, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Ex-Officio Members of Executive Committee

Edward M. Abbot, '04
Henry A. Bodwell, '00
Charles W. Churchill, '06
Thomas T. Clark, '10
Tracy A. Adams, '11
Stanley H. Wheelock, '05
Royal P. White, '04

Executive Committee
15 *Members*

Roy H. Bradford, '06
Alexander Campbell, '23
Earl W. Clark, '18
James F. Dewey, '04
Russell T. Fisher, '14
Olin D. Gay, '08
Frederic S. Gilley, '16
Thomas Joy, '26
Arnold J. Midwood, '05
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Dean W. Symmes, '22
J. Milton Washburn, '21
A. Edwin Wells, '20

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term

(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	120
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	90

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

FIRST YEAR. SECOND TERM. (HOURS OF EXERCISE)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	120	Textile Design and Cloth Analysis D–10	90
Mathematics B–10	60		
Mechanism B–12	60		

SECOND YEAR. FIRST TERM

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

SECOND YEAR. SECOND TERM

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

THIRD YEAR. FIRST TERM

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

THIRD YEAR. SECOND TERM

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75
English E–10	45
Machine Drawing B–13	120
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–11a	45
Textile Design and Cloth Analysis D–10	90

Second Year. First Term

Fiber Preparation G–20–21	240
Physics B–23a	45
Power Weaving D–24	105
Steam Engineering B–24	30
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–21	75

Second Year. Second Term

Fiber Preparation G–20–21	270
Physics B–23a	45
Power Weaving D–24	120
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–21	60

Third Year. First Term

Electricity B–31a	30
Mill Engineering B–34a	30
Power Weaving D–32	135
Textile Testing G–31	30
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	225

Third Year. Second Term

Knitting F–31	120
Power Weaving D–32	105
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	225
Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	120	Textile Design and Cloth Analysis D–10	90
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20a	90	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20, 21	240
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20–21	90	Textile Design and Cloth Construction D–20, 21	135
Jacquard Design D–23	45		
Physics B–23a	45		
Power Weaving D–24	120		

Third Year. First Term

Color and Dynamic Symmetry D–42	30	Textile Design and Cloth Construction D–30	105
Cotton Finishing H–31	75	Textile Testing G–31	30
Cotton Yarn Manufacture F–30a	60	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	60	Worsted Yarn Manufacture G–30	90

Third Year. Second Term

Cotton Finishing H–31	75	Woolen and Worsted Finishing H–30	75
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	60
Jacquard Design D–31	75	Thesis.	
Power Weaving D–32	105		
Textile Design and Cloth Construction D–30	75		

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultramicroscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several optional subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Adv. Organic Chemistry C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–23	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Adv. Organic Chemistry C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15	Economics E–30	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
		Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	75	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Photography C–37	15
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
Organic Laboratory C–36	90	Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	90	Options or Thesis C–52	90
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Organic Laboratory C–41	90
Chemical Textile Testing C–43	45	Quantitative Analysis C–46	15
Industrial Chemistry C–42	30	Report Writing C–47	15
Microscopy and Photomicroscopy C–45	60	Technical German C-40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Options or Thesis C–52	90
Adv. Textile Chemistry and Dyeing Lab. C–44	90	Organic Laboratory C–41	105
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Rayon Manufacturing C–51	30
Chemical Textile Testing C–43	45	Technical German C–40	30
Engineering Chemistry C–50	45	Technology of Wool Manufacture G–40	15
		Textile Literature C–48	15

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The student is first thoroughly grounded in those fundamental principles of science upon which all industrial and engineering work rests. The foundation of his textile and technical training is in the subjects of mathematics, physics, chemistry, drawing, mechanics, mechanism, and technology of fibers, and their practical application.

Instruction is given in all the various branches of textile manufacturing through lectures, recitations and laboratory work. A large proportion of his time is spent in well-equipped textile departments where he studies and operates all of the machinery required in the conversion of cotton and wool fiber into yarns and fabrics. This includes cotton, wool and worsted yarn manufacturing, designing, weaving, knitting, dyeing and finishing. In his last year the course in textile testing acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering.

Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice.

Mill engineering familiarizes the student with mill design, construction, heating, lighting, humidification and fire protection. The arrangement of machinery and buildings for most efficient production and economical power distribution is also studied in detail.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

For the student who may desire the breadth of technical training which this course offers, but who wishes to specialize in either cotton or wool manufacturing, two options are offered. In these optional courses the student's entire textile time is devoted to the study of that particular fiber which he elects. Provision is also made for the substitution of knitting for weaving laboratory time in the case of those who prefer to lay more emphasis on knit fabrics.

During the past few years a demand has come from the distributing or marketing branches of the textile business for men with a four years' technical training. With the idea of offering courses which may better prepare graduates to meet this new call, the new Sales Option Course is offered.

There are also requests for a four-year Design Course which, while majoring in Textile Design, includes other subjects that help to make a broader course than the one of three years' duration. For this purpose the Design Option Course is offered. Like the other courses outlined, these will be subject to changes to meet new demands.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Cotton Yarn Manufacture F–20a	75	Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C–20	30
Machine Drawing B–21	75		
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		
Heat Engineering B–32	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Mill Engineering B–45	75
Cotton Organization F–32	90	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Testing B–43	45
Microscopy B–41	45	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	225	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–20	30
Machine Shop B–26	45		
Mathematics B–20	60		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Physics B–23	75
Cotton Yarn Manufacture F–20a	165	Power Weaving D–24	105
Machine Drawing B–21	45	Textile Chemistry and Dyeing Lect. C–20	30
Mathematics B–20	60		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	150	Power Weaving D–32	45
Economics E–30	45	Textile Design and Cloth Construction D–20	90
Electrical Engineering B–31	75		

THIRD YEAR. SECOND TERM

Cotton Yarn Manufacture F–30a	150	Mill Engineering B–34	90
Economics E–30	45	Textile Design and Cloth Construction D–20	75
Electrical Engineering B–31	75		
Heat Engineering B–33	90		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Design and Cloth Construction D–30	30
Cotton Organization F–32	105	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Testing B–43	45
Microscopy B–41	45	Thesis	75
Mill Engineering B–45	30		

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31a	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Fiber Preparation G–20, 21	225	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–20	30
Machine Shop B–26	45		
Mathematics B–20	60		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B–21	45	Textile Chemistry and Dyeing Lect. C–20	30
Mathematics B–20	60		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

THIRD YEAR. SECOND TERM

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Design and Cloth Construction D–21	75
Electrical Engineering B–44	75	Textile Marketing B–42	30
Microscopy B–41	45	Textile Testing B–43	45
Mill Engineering B–45	30	Thesis	135

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31a	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		
Textile Design and Cloth Construction D–30	135		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Textile Physics B–37	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Power Weaving D–32	135	Woolen and Worsted Finishing H–30	75
Textile Design and Cloth Construction D–30	60		

Fourth Year. First Term

Accounting B–40	90	Textile Design and Cloth Construction D–41	90
Color and Dynamic Symmetry D–42	30	Textile Marketing B–42	30
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Microscopy B-41	45	Textile Testing B–43	45
		Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Jacquard Design and Weaving D-40	120
Color and Dynamic Symmetry D–42	30	Textile Design and Cloth Construction D–41	90
Cotton Finishing H–31	105	Thesis	90

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F-20a	60	Textile Chemistry and Dyeing Lecture C-20	30
Fiber Preparation G-20, 21	90	Textile Design and Cloth Construction D-20, 21	210
Mathematics B-20	60		
Physics B-23	75		

Second Year. Second Term

Cotton Yarn Manufacture F-20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G-20, 21	90	Textile Design and Cloth Construction D-20, 21	105
Mathematics B-20	60		
Physics B-23	75		
Power Weaving D-24	105		

Third Year. First Term

Cotton Yarn Manufacture F-30a	60	Textile Design and Cloth Construction D-30	135
Economics E-30	45	Worsted Yarn Manufacture G-30	90
Power Weaving D-32	75	Woolen and Worsted Finishing H-30	75
Principles of Marketing B-35	45		

Third Year. Second Term

Cotton Yarn Manufacture F-30a	60	Textile Design and Cloth Construction D-30	60
Economics E-30	45	Textile Physics B-37	60
Marketing Methods B-36	60	Worsted Yarn Manufacture G-30	90
Power Weaving D-32	30	Woolen and Worsted Finishing H-30	75
Statistics	45		

Fourth Year. First Term

Accounting B-40	90	Selling Policies B-52	45
Color and Dynamic Symmetry D-42	30	Textile Design and Cloth Construction D-41	60
Microscopy B-41	45	Textile Styling B-50	30
Principles of Selling and Advertising B-49	105	Textile Testing B-43	45
		Thesis	75

Fourth Year. Second Term

Business Administration B-46	90	Foreign Trade and Economic Geography B-51	45
Color and Dynamic Symmetry D-42	30	Knitting F-31a	75
Cotton Finishing H-31	105	Selling Policies B-52	45
		Thesis	135

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration and applications of integration. In the second term the

topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B–20a. Preparation: B–10. This subject is a continuation of the work of the first year subject B–10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B–21. Preparation: B–10, B–12, B–14. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B–23. Preparation: B–10 and B–11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, the vernier, wave motion and sound.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—nature and propagation of light, reflection and refraction lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B–23a. Preparation: B–10 and B–11. This subject consists of the same topics as B–23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B–24. Preparation: B–12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B–25. Preparation: B–11, B–20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B–26. Preparation: B–11 and B–12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as possible to commercial machine-shop practice on textile machinery. The list of

tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B-30. Preparation: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B-31. Preparation: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B-31a. Preparation: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B-32. Preparation: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser tests; non-condensing and condensing engine and turbine tests;

heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

Principles of Marketing—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Textile Physics—B-37. Preparation: B-23. The work in this subject consists of experimental determinations of the physical properties of textile fibers, yarns and fabrics. Special emphasis is placed upon the study of properties which determine the color characteristics of textile materials. [Course VI, Design and Sales Options.]

Accounting—B-40. Preparation: B-10 and E-30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Microscopy—B-41. Preparation: B-23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes sectioning and mounting, measurements of diameter and twist, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumina-

tion and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: B–37, D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparation: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C–10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–11. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–11a. Preparation: C–10, taken simultaneously. This course is similar to C–11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–12. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, B–12, B–14. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing

agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C–20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C–22. Preparation: C–10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dye-

stuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C-23. Preparation: C-11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Smith's "Quantitative Chemical Analysis" is used as a text. [Course IV.]

Stoichiometry—C-24. Preparation: B-10, C-10, C-12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C-30. Preparation: C-23. The fundamental principles acquired in Course C-23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, textile fabrics, stripping agents, acids and alkalies. The latest and most practical methods are employed. Griffin's "Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C-31. Preparation: C-22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's "Industrial Chemistry." Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-32. Preparation: C-20, C-21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Photography—C–37. Preparation: B–23, C–20, C–22, C–23. Photography is today indispensable to the scientist and textile chemist. Without the aid of photography he cannot preserve and keep an absolute and accurate record of his investigations and research problems.

The Institute therefore offers to the senior chemists an eight-weeks' course in the elements of Photography. One object of this course is to provide the student with the preliminary knowledge and training necessary for the course in Microscopy and Photomicrography which follows.

The course includes a study of the different types of cameras and lenses, the making of contact prints from classified negatives using various grades of papers, reduction and intensification of negatives, enlarging, copying, negative making and lantern slide preparation.

The theory and chemistry of the above subjects are not only covered in the classroom but in addition all of this work is actually carried on by each individual student in the Photographic Laboratory and Dark Room. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and apparatus used in testing and evaluating textile materials. Emphasis is given to those tests which may be used to give a chemist valuable information as to the source and quality of textiles. The last part of the work consists of chemical and optical tests which may be necessary to a textile chemist in either routine or research work. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22, C–37. The value of the microscope in the identification of textile materials and the examination of textile yarns and fabrics cannot be overestimated. In conjunction with photomicroscopy a permanent record which may be filed for future reference and which is understandable by non-technical men is obtained.

In this course the students are given instruction in the use and construction of various types of microscopes and accessories; the preparation and mounting of samples; the identification of starches and fibers; microchemical reactions; and examination of fabrics for faults. Actual unknown fibers, starches and fabrics are examined and reported upon.

Following microscopy, the student takes up photomicroscopy, for which he has been prepared by a thorough course in the common processes of photography. The types and constructions of photomicrographic apparatus, adjustments, and exposures are taught by actual work in the photomicrographic laboratory. The student studies the use of such auxiliaries as color filters, polarized light, darkground illumination, color photography, and works at both high and low magnifications. At the end of the course the student is given a typical industrial or research problem on which he works independently and upon which he must prepare a complete report, illustrated by appropriate photomicrographs. [Course IV.]

Quantitative Analysis—C-46. Preparation: C-30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C-47. Preparation: B-20a, E-20. The purpose of this course is to enable the student to write a technical report clearly. An analysis of a complete research is first made. This is followed by a bibliography and instructions in the use of reference books and technical journals. Methods of obtaining and interpreting laboratory data are given and the elements of statistical analysis demonstrated and used. Instruction and illustrations of various technical and non-technical, formal and informal, laboratory and plant reports are given. [Course IV.]

Textile Literature—C-48. Preparation: C-47. The object of this course is to introduce the student to the current sources of information on textile chemical subjects. Each student is assigned a subject and is required to keep informed on that subject by first a survey of the literature and then the reading of current technical journals. Reports are tendered informally and orally. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-11, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Engineering Chemistry—C-50. Preparation: C-22, C-23. This course consists of a series of lectures covering the derivation, sampling, analysis, and specification of coals, gasolines, kerosenes, fuel gases, flue gases, oils, greases, and boiler waters. This is followed by a study of combustion and the underlying principles of lubrication. The lectures are supplemented by laboratory work consisting of complete analyses of coal, gasoline, oil, grease, flue gas, and illuminating gas. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C-51. Preparation: C-32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Optional Subjects or Thesis during fourth year—C-52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take optional work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several options were introduced, each optional period being 45 hours per term and four of these being required during the year.

If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more option periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or optional subjects, will be required for graduation.

Options: Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry varying from year to year.

Photomicroscopy. A series of laboratory experiments followed by a research problem in photomicroscopy. Effects of the optical system, exposure, polarized light and dark ground illumination are studied and color photomicroscopy is included as far as time permits.

Colloid Chemistry. A seminar course on general colloid chemistry with special applications to textiles. The colloid chemistry of dyeing, the action of detergents, and the swelling effects of various materials on the fibers are especially emphasized.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conductivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed

to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options C, D, S.]

Jacquard Design—D-31. This is a continuation of Jacquard Design D-23. [Course III.]

Power Weaving—D-32. Preparation: D-20, D-21, or D-23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Jacquard Design and Weaving—D-40. Preparation: D-23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Option D.]

Textile Design and Cloth Construction—D-41. Preparation D-10, D-20, D-21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Color and Dynamic Symmetry—D-42. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is ele-

mentary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

COTTON DEPARTMENT—F

Cotton Carding—F-20. Preparation: B-10, B-12, B-14. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as

eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin and Nasmith combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine and jack are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F–20a. Preparation: B–10, B–12, B–14. This course is similar to Course F–20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions.

The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II.]

Knitting—F–31a. Preparation: B–12, D–10. This course embraces the same lectures as Course F–31 but does not include any laboratory work. [Course VI, Options G, C, W, S.]

Cotton Organization—F–32. Preparation: F–20 or F–20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Thesis—F–34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

WOOL DEPARTMENT—G

Fiber Preparation—G–20. Preparation: B–10, B–12, B–13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in washing; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the

hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.—Mixing and shading of colors and qualities of wool are studied and practiced. The details of burr pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning.—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W, D, S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G-31. Preparation: B-23, F-30 or G-30, D-24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course

of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G–40. Preparation: C–21, C–32, D–10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H–30. Preparation: B–12, C–10, D–10, D–24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods

of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time, and each year some new machine will be added by a manufacturer who finds it to his advantage to be represented here. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker. This machine is equipped with blade beaters in the first two sections and either a blade or a Kirschner beater in the third section. It has the new blending reserve, automatic rack release and the hunting cog knock-off.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. One frame is equipped with both common and metallic drawing rolls, electric stop motions and Ermine top roll clearers. The other frame and the railway head both are equipped with metallic rolls and mechanical stop motions. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough. The last named serves to illustrate the common English construction and how it differs from the American construction as illustrated in the other roving machines.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. Four of these frames are equipped with individual motor drives,—one chain drive, one Texrope drive, one gear drive and one Washburn clutch drive. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames, and has an individual alternating current motor connected through a Reeves automatically controlled variable speed drive. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. This machine is equipped with an individual alternating current motor with a chain drive. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity. This equipment is suitable to spin coarse numbers from cotton wastes to be used in such materials as coarse sheeting, osnaburgs, twine and mop yarns.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired percent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. In addition, there is a gas conditioning oven to use in determining moisture content and regain. A number of scales and balances, together with yarn reels, roving reels and measuring boards make up the equipment for routine mill sizing tests.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton,

worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B-5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division.—The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company of North Andover, Mass.: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company; one mule headstock mounted on trucks for instruction purposes; one fancy yarn twister with chain and gear equipment; one filet winding drum stand with tension bars, wind, etc., for applying card clothing.

Installed by C. G. Sargent's Sons Corporation, Graniteville, Mass.: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc., of Worcester, Mass.: One 120-spindle cam mule complete; one mule headstock mounted on trucks for instruction purposes.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son, Worcester, Mass.: One card grinding stand with two traverse grinders complete.

Equipment: Modern ferrule type fiber head jack spools and bobbins by U. S. Bobbin and Shuttle Company of Lawrence; yarn baskets by Steele Supply Com-

pany, Cambridge, Mass.; hand cards by Howard Brothers of Worcester and Davis & Furber Machine Company; ring travellers by Victor Company; static suppressors by Chapman Neutralizer Company.

Shoddy or Reworked Fiber Division.—Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division.—Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., Leeds, England, equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops of Biddeford, Me.; two worsted combs with baller punch, one made by Crompton & Knowles, Worcester, and the second made by James Smith & Sons, of Worcester, Mass.; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stell, Keighley, England.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, Keighley, England, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap spinner, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer spinner, one 12-spindle ring spinner, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. In addition to this the Saco-Lowell Shops, Biddeford, Me., have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system through its automatic control. In this laboratory are installed six humidifiers and four Comin's High Duty heads, which are supplied from an electric-driven triplex power pump located in the power house. This same pumping equipment supplies the American Moistening Company's humidifiers operating in the Cotton Yarn Department.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning, the machinery has been made by the Société Alsacienne de Constructions Mechaniques, Mulhouse, France, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads), gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles

for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company, Fitchburg, Mass. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

Textile Testing Division.—Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company of Boston; single yarn and fabric strength-testing machines made by G. R. Smith & Company, Bradford, England; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper, Leipzig, Germany. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company of Providence, R. I., a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, also an abrasion machine for testing resistance to wear of twines, tapes, and all stripped flat fabrics, one General Electric mercury vapor lamp with stand for top inspection. For the automatic control of temperature and humidity there has been installed by the American Moistening Company, of Boston, one of its automatic humidity and temperature regulators.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company of New York.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company of Lowell. The Whitin Machine Company, Whitinsville, Mass., has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, Worcester, Mass., a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8-spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company of North Andover, Mass.

The Weaving Department contains four looms supplied by the Draper Corporation of Hopedale, Mass., which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company of Readville, Mass., has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, Whitinsville, Mass., a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company, Lisbon Falls, Maine. The Hopedale Manufacturing Company of Milford, Mass., has recently installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 16-harness lappet loom, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton

24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company, Clinton, Mass. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons, Paterson, N. J.; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table, with ample facilities to provide distilled water through the use of a Barnstead Water Still. The Balance Room, which is adjacent to the laboratory, has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé refractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with individual benches, small dyeing apparatus, reels, balances, apparatus for dye testing, such as frames for exposing dyed material to light, and a complete collection of dyestuff samples and sample cards. There are also fifty-six steam coil experimental dyeing baths, a drying chamber and ageing chamber, in addition to a Hurricane Dryer, Class D, made by the Philadelphia Drying Machinery Company, Pennsylvania. Adjacent to the Experimental Dyeing Laboratory there has been provided a well-lighted room for the storage of a great variety of dyestuffs. Steel shelving has been arranged so that the samples are easy of access. All samples are catalogued in a card file, thus facilitating their use.

The Industrial Chemistry Laboratory contains the following: one filter press, type E. T. Shriver & Company; a single-acting triplex plunger pump, Goulds Manufacturing Company; a vacuum drying apparatus, a surface condenser, a Packard vacuum pump, Norman Hubbard's Sons; a vacuum evaporator, Swenson system, American Foundry and Machine Company; a centrifugal, C. H. Chavant & Company; a double jar mill, F. I. Stokes & Company.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, Worcester, Mass., a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter, the Permutit Company, New York City; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine, the Textile-Finishing Machine Company, Providence, R. I.; a set of drying cans by the same concern; a chain dyeing machine, T. C. Entwistle Company, Lowell, Mass.; a raw stock drying table, Proctor & Schwartz, Philadelphia, Pa.; a padding mangle, Arlington Machine Works, Arlington, Mass.; a hydro-extractor, W. H. Tolhurst & Son, Troy, N. Y.; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. The Franklin Process Company, Providence, R. I., has furnished a 25-pound bronze dyeing machine. Of the various dye tubs, one is equipped with a Monel metal lining to withstand the action of various chemicals and dyes.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company, Orange, Mass.; a sample fulling mill, a kicker mill, furnished by James Hunter & Company, North Adams, Mass.; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company of Worcester has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air-cooling machine, equipped with a direct connected motor and a Nash pump; a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A.W.C. measuring and weighing machine, furnished by Parks & Woolson, Springfield, Vt.; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co., Woonsocket, R. I.; a tentering and drying machine furnished by John Heathcote, Providence, R. I.; a single crabbing machine, H. W. Butterworth & Son, Philadelphia, Pa.; a 72-inch woolen napper donated by Davis & Furber, North Andover, Mass.; a 32-inch basket hydro-extractor, W. H. Tolhurst, Troy, N. Y.; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company, New York; a steam press for underwear, United States Hoffman Company, Syracuse, N. Y.; a sewing machine, Birch Brothers, Somerville, Mass.; a

trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company, Worcester, Mass.; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company, Salem, Mass.; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers, Somerville, Mass.; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber, North Andover, Mass. (the ball bearings were donated by the Fafnir Bearing Company, New Britain, Conn.); an 8-inch belt lacer furnished by the Clipper Belt Lacer Company of Grand Rapids, Mich.; a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company, Boston; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system, Files Engineering Company, Inc., Bridgeport, Conn.; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company, Providence, R. I.; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company, Providence, R. I.; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company, Boston, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company, Philadelphia, Pa. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company, Boston, Mass.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alder absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments. For the measurement of flow of air there are a steam-driven Sturtevant fan and a motor-driven Massachusetts fan with heater combined for heating and drying experiments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-Kilowatt rotary transformer and three Westinghouse stationary transformers. The other section of the laboratory is known as the instrument laboratory and is for the purpose of giving instruction in the measurement of current voltage, resistance, and in the calibration of instruments. It contains a 5-kilowatt Crocker-Wheeler balancer, a 160-ampere hour storage battery, a 5-kilowatt 220-volt to 440-volt General Electric transformer, a Westinghouse portable wattmeter with current and potential transformers, three wattmeters, two ammeters and a voltmeter, all of the General Electric portable alternating current type, a 30-volt alternating current Roller Smith voltmeter, a 5 to 10-scale Weston ammeter (electro-dynamometer type), a Weston millivoltmeter with 2, 20, 50 and

200 ampere shunts, three 250-volt direct current Weston voltmeters, a 150-ampere, two model 45, two model 260, Weston portable ammeters, a Weston model 260 voltmeter, a Thompson 50-ampere recording wattmeter, a General Electric rotating standard wattmeter, two General Electric induction type watt hour meters, an Esterline portable curve drawing wattmeter, a 100-ampere Leeds & Northrup Standard Resistance, a Leeds & Northrup Ayrton shunt, a Weston laboratory standard voltmeter with 600-volt multiplier, a Leeds & Northrup potentiometer, a D'Arsonval wall type galvanometer, a Wheatstone bridge with galvanometer, a slide wire bridge and electro-dynamometer, Weston Standard cell, potential phase shifter, a standard Leeds & Northrup photometer with Lummer-Brodhun screen, and Macbeth illuminometer made by the same concern.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10-foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company, Nashua, N. H.; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company, Worcester, Mass.; an engine lathe, 18-inch swing, 6-foot bed from Champion Tool Works, Cincinnati, Ohio; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons, Fitchburg, Mass.; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company, Milwaukee, Wis.; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company, Nashua, N. H.; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son, Worcester, Mass.; one 14-inch single sensitive drill, from the Stanley Manufacturing Company, Lawrence, Mass.; one No. 1 Universal grinder, from Landis Tool Company, Waynesboro, Pa.; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount, Everett, Mass.; an American twist drill grinder, from the Heald Machine Company, Worcester, Mass.; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company, Cincinnati, Ohio; one 30-inch grindstone and frame, from the Athol Machine Company, Athol, Mass.; a single spindle centering machine, from D. E. Whiton Machine Company, New London, Conn.; one 15-inch shaper, from Potter & Johnson, Pawtucket, R. I.; one power hacksaw, from the Fairbanks Company, Boston, Mass.; one cold saw, from John T. Burr & Son, Brooklyn, N. Y.; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

Power, Light, Heat and Ventilating Plant.—In the powerhouse there is located the main power-generating apparatus for supplying light, heat and power to all departments of the Institute. The equipment here consists of: two 250-horsepower Heine water tube boilers, one equipped with a Jones stoker and one with Perfection grate, a 300-horsepower Aultman & Taylor horizontal water tube boiler, equipped with United States rocking grates, two boiler feed pumps—one a Knowles and the other a Deane—a 40,000-pound Cochrane metering open-feed heater, which is provided with a Lea recorder, and a Cochrane oil extractor which heats and measures all feed water, a 3-inch Venturi meter in feed line with indicating manometer as made by the Builders Iron Foundry, Providence, R. I. In the Engine Room are located: a Payne 14 by 14 automatic high speed engine, 125-horsepower direct connected to 75-kilowatt, 220-volt, direct-current Bullock generator; a 9½ by 11 Nash gas engine of 50-horsepower, 4-cycle type, direct connected to a 30-kilowatt, 220-volt, direct-current Bullock generator; a 65-kilowatt motor generator set, consisting of a direct current motor and an alternating current generator made by the Westinghouse Electric and Manufacturing Company; a steam-driven Ingersoll-Rand 8 by 8 air compressor, for use with Turbo heads, installed in the French Spinning Department by the G. M. Parks Company, Fitchburg, Mass. The station switchboard is of marine-finished slate, 90 inches in height, and consists of three generator panels and two circuit panels.

The powerhouse is connected with the main school buildings by a tunnel through which all wires, steam and water pipes are carried.

GRADUATES WITH TITLES OF THESES

June 5, 1934

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Textile Chemistry and Dyeing, no thesis subjects have been listed.

Grover Stanley Allen	Haverhill, Mass.
Edgar Raymond Beigbeder	Roslindale, Mass.
John Lincoln Birtwell	East Chelmsford, Mass.
Mitchell John Bukala	Lowell, Mass.
James Edward Burke, Jr.	Lowell, Mass.
Charles Lincoln Daley	Lowell, Mass.
Francis Clifford Gillespie	North Andover, Mass.
Mitchell Glowienski	Lowell, Mass.
Robert Theodore Graham	North Andover, Mass.
Glen Mortimer Kidder	Ayer, Mass.
Raymond Lewis Matthews	Gardner, Mass.
Leon Eugene Moody	Lowell, Mass.
Roland Charles Morrison	Dracut, Mass.
Shantilal Hiralal Shah	Bombay, India
Harold Smith	Lowell, Mass.
Robert Joseph Thomas	Lowell, Mass.
William Joseph Wynn, Jr.	Lowell, Mass.

Bachelor of Textile Engineering

Edward Joseph Donohoe, Lowell, Mass. "The Actual Construction of and Tests with the Apparatus for the 'Modified Box Test' for Waterproofness of Fabrics."

Parker Frank Dunlap, Lowell, Mass. "The Calibration of a Portable Instrument for Measuring Air Permeability of Fabrics." Thesis with Robert C. Gregory.

George Forsythe, Andover, Mass. "An Investigation of the Properties of Cotton Yarns Produced from Single and Double Roving by Regular and Long Drafts." Thesis with Benjamin Thomas, Jr.

David James Fox, Lowell, Mass. "The Effect of Regain on the Tensile Strength and Elongation of Viscose Rayon Yarns."

Alden Ives Gifford, Jr., Lowell, Mass. "A Study of the Effect of Weave on the Physical Properties of Cotton Fabrics."

Robert Crockett Gregory, Rockland, Me. Thesis with Parker F. Dunlap.

Russell Munroe Lawson, Andover, Mass. "The Manufacture and Color Measurement of a Designer's Blanket."

Gerald Alderic Leblanc, Lowell, Mass. "A Study of the Possibility of Using the Verigraph to Determine the Regain of Fabrics."

John Charles Lowe, Dracut, Mass. "An Investigation of the Effect of the Increase in the Weight of the End after it Leaves the Noble Comb on the Number of Operations Necessary to Produce Roving."

Simon Shapiro, Lowell, Mass. "A Study of the Relation Between the Plating of Knitting Yarn and the Twist in the Plating Yarn."

Benjamin Thomas, Jr., Nashua, N. H. Thesis with George Forsythe.

Robert Campbell Wilkie, Newton Centre, Mass. "The Development of a Method for Determining the Moisture Content, Grease, Suint or Water Soluble, and Dirt and Vegetable Matter of Grease Wools."

Diploma in Cotton Manufacture

William Edwin Stevens, West Warwick, R. I. "The Comparison of the Relative Uniformity and Strength of Combed Yarns with Various Percentages of Noil Removed."

Diploma in Wool Manufacture

Herbert Gardner Bridges, West Newbury, Mass. "The Duplication of a Worsted Suiting."

William Francis Huyck, Chelmsford, Mass. "The Manufacture of a Fancy Worsted."

Prizes awarded in June, 1934

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *David James Fox.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Leon Eugene Moody.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Herbert Alvin Wormwood.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *Moushy Markarian.* Honorable mention, *Lee Gale Johnston* and *Bernard James Tyler.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Hugh Francis Carroll.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Robert Keith Lyle.* Honorable mention, *Richard Moushegian.*

REGISTER OF DAY STUDENTS

Candidates for Degree

Class of 1935

Home Address	*Lowell Address*
Alcott, Albert Stephen, Jr., IV, Lowell, Mass.	59 Canton Street
Beattie, John Silas, IV, Lowell, Mass.	285 Foster Street
Bogdan, John Francis, VI, Nashua, N. H.	———
Bradford, Edward Hosmer, VI, Andover, Mass.	———
Connolly, Daniel Francis, Jr., VI, Salem, Mass.	2 Mill Street, Collinsville
Cowan, Raymond Bernard, IV, Haverhill, Mass.	Sigma Omega Psi House
Curtin, William John, IV, Lowell, Mass.	49 Second Street
deGruchy, James Campbell, Jr., IV, Stoneham, Mass.	———
Dion, Ernest Lorenzo, IV, Lawrence, Mass.	———
Echavarria, Luis, VI, Medellin, Colombia	142 Riverside Street
Eismann, Edmund, IV, Pawtucket, R. I.	9 White Street
Fairbanks, Evan Hobbs, VI, Wakefield, Mass.	Omicron Pi House
Farkas, Zoltan Roland, IV, Lowell, Mass.	32 Mt. Washington Street
Freeman, Arthur Samuel, VI, Chelsea, Mass.	———
Greenbaum, Hyman Herbert, IV, Haverhill, Mass.	———
Griffin, Vernon Harcourt, IV, Swampscott, Mass.	Omicron Pi House
Grossman, Edward, VI, Providence, R. I.	Sigma Omega Psi House
Harwood, Ralph, IV, Bronx, N. Y.	Sigma Omega Psi House
Heffernan, John Vincent, IV, North Smithfield, R. I.	142 Riverside Street
Holden, Arthur Newton, VI, No. Billerica, Mass.	———
Kopatch, Chester Marion, IV, Lawrence, Mass.	———
Lauder, Robert William, VI, Haverhill, Mass.	———
Leslie, Kenneth Everett, IV, Haverhill, Mass.	———
Lokur, Swamirao Ramrao, IV, Ahmedabad, India	53 Mt. Hope Street
Moreno, Emilio Gomez, Jr., VI, Lowell, Mass.	28 Loring Street
Parechanian, James Humphrey, IV, Lowell, Mass.	1 Summer Court
Phelan, Leonard John, IV, Ipswich, Mass.	137 Riverside Street
Plovnick, Max David, IV, Roxbury, Mass.	17 Mt. Vernon Street
Poremba, Leo Louis, IV, Lowell, Mass.	4 Oak Street
Schoelzel, Herman Walter, IV, Methuen, Mass.	———
Shain, Joseph, IV, Roxbury, Mass.	17 Mt. Vernon Street
Stein, William Joseph, VI, New Haven, Conn.	Sigma Omega Psi House
Stolzberg, Howard Nathaniel, IV, Haverhill, Mass.	Sigma Omega Psi House
Storey, Edwin Gerald, VI, Chatham, N. J.	43 Plymouth Street
Thompson, George Robert, IV, Lowell, Mass.	39 Roper Street

Class of 1936

Anthony, Henry Steere, IV, Lowell, Mass.	20 Loring Street
Basdikis, Charles Apostolos, IV, Lowell, Mass.	8 LaGrange Street
Bates, Wesley Elliot, VI, East Milton, Mass.	———
Boyd, William, Jr., IV, Providence, R. I.	52 Colonial Avenue
Cobb, Joseph Calvin, VI, Dorchester, Mass.	———
Cogswell, Frederick William, IV, Maynard, Mass.	———
Conant, Gilman Wright, VI, Newtonville, Mass.	Omicron Pi House
Crawford, Robert Thomas, VI, Boston, Mass.	———
Fuller, Roland Monroe, VI, Lowell, Mass.	R. F. D. No. 1
Gagnon, Roland Octave, IV, Lowell, Mass.	279 Liberty Street
Georgacoulis, George, IV, Lowell, Mass.	336 Suffolk Street
Hodgman, Richard Albert, VI, Stoneham, Mass.	———
Holgate, Benjamin Alexander, VI, Lowell, Mass.	97 Grove Street
Ireland, Wilson Gerard, VI, Melrose, Mass.	Omicron Pi House

Home Address	*Lowell Address*
Johnston, Lee Gale, IV, Haverhill, Mass.	———
Kaiser, Raymond John, VI, Bloomfield, N. J.	Omicron Pi House
Landau, David, IV, Brooklyn, N. Y.	Sigma Omega Psi House
Lee, Shao-fong, VI, Shanghai, China	53 Mt. Hope Street
Lincoln, Charles Ernest, IV, Mattapan, Mass.	———
McQuade, Allan John, VI, Lowell, Mass.	600 Andover Street
Markarian, Moushy, IV, Lowell, Mass.	103 Lawrence Street
Olshinski, Matthew John, VI, Chelmsford, Mass.	———
Redmond, James Reynolds, IV, Lowell, Mass.	84 Bartlett Street
Roarke, John James, IV, Lowell, Mass.	75 Viola Street
Schaller, Joseph Gregory, IV, Wellesley, Mass.	11 White Street
Shah, Kantilal Hiralal, VI, Bombay, India	53 Mt. Hope Street
Smith, William Arthur, Jr., VI, Lowell, Mass.	14 Mt. Washington St. No. 3
Sullivan, Joseph Augustus, VI, Lowell, Mass.	28 Grove Street
Thompson, Henry Albert, IV, Lowell, Mass.	R. F. D. No. 1
Tyler, Bernard James, IV, Lowell, Mass.	30 Epping Street
Urbanetti, Anthony Joseph, IV, South Manchester, Conn.	65 Sterling Street
Valentine, Preston Sumner, IV, Cochituate, Mass.	53 Mt. Hope Street
Welch, William Paul, Jr., IV, Lowell, Mass.	76 South Highland Street
Wormwood, Herbert Alvin, IV, North Wilmington, Mass.	———

Class of 1937

Allard, Frederick Pratt, IV, Lowell, Mass.	104 Eleventh Street
Bassett, Louis Loss, VI, New Haven, Conn.	17 Mt. Vernon Street
Berg, Abraham David, VI, Brooklyn, N. Y.	17 Mt. Vernon Street
Boordetsky, Sidney Morris, VI, Cambridge, Mass.	———
Carroll, Hugh Francis, IV, Medford, Mass.	———
Churchill, Harry Coburn, IV, Lowell, Mass.	214 Third Street
Clarke, John Thomas, VI, Chelmsford, Mass.	———
Cutrumbes, Demosthenes John, IV, Dracut, Mass.	———
Daly, William James, VI, Andover, Mass.	———
Depoian, Vasken John, IV, Lowell, Mass.	8 Gates Street
Dupee, George Richardson, VI, Lowell, Mass.	213 Branch Street
Fisher, Thomas Nathan, VI, Lowell, Mass.	100 Sanders Avenue
Hadley, George Clarence, Jr., B.S. in A.E., VI, North Adams, Mass.	Omicron Pi House
Hakanson, Gustave Warren, IV, Winchester, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	714 Gorham Street
Kennedy, Robert Gilman, IV, Lowell, Mass.	223 Pine Street
Kimball, Harlan LeDoit, IV, Lowell, Mass.	119 Sherman Street
LeBel, Claude Merwin, VI, New York, N. Y.	2 Mill Street, Collinsville
Lemkin, Uriel William, VI, Lowell, Mass.	24 D Street
Luescher, Frank Oscar, IV, Pawtucket, R. I.	9 White Street
Lyle, Robert Keith, IV, Lowell, Mass.	86 Orleans Street
Megas, Charles, IV, Lowell, Mass.	114 Rock Street
Moushegian, Richard, IV, Lowell, Mass.	400 Central Street
Natsios, Basil Andrew, IV, Lowell, Mass.	98 Lewis Street
Nerney, Francis Xavier, IV, Lowell, Mass.	46 Dana Street
Olcott, Harry Depew, IV, Lowell, Mass.	56 Montview Avenue
Reed, Harold Ernest, VI, Nashua, N. H.	———
Regan, Paul William, IV, Lowell, Mass.	16 Linden Street
Robbins, Lucy Wiley, VI, Lowell, Mass.	102 South Loring Street
Rosenberg, Jacob, VI, Westerly, R. I.	37 Hanover Street
Spanos, James Peter, IV, Lowell, Mass.	14 West Bowers Street
Stanley, Donald Edward, IV, Lowell, Mass.	706 Stevens Street
Vaniotis, Socrates Vasilios, IV, Lowell, Mass.	13 Willie Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlboro Street

Home Address	*Lowell Address*
Wilkinson, Herbert William, Jr., IV, Edgewood, R. I.	Omicron Pi House
Wright, George Ward, Jr., IV, Newtonville, Mass.	Omicron Pi House

Class of 1938

Broadhurst, Russell Denton, IV, Middletown, Conn.	50 Standish Street
Buckley, Herman Timothy, IV, East Chelmford, Mass.	———
Cherr, Alda Jay, IV, New York, N. Y.	125 Mt. Washington Street
Comstock, Tom, VI, Great Barrington, Mass.	137 Riverside Street
Copp, Sewall Edward, VI, Brockton, Mass.	49 Salem Street, Haverhill
Cordeau, Raymond Wilfred, IV, Lowell, Mass.	1014 Lakeview Avenue
Dori, Anita Marie, VI, Chester, Mass.	63 Varnum Avenue
Fine, Milton Arnold, VI, Brighton, Mass.	———
Fox, Kenneth Russell, VI, Lowell, Mass.	359 Beacon Street
Freedman, David, VI, Boston, Mass.	17 Mt. Vernon Street
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Garcia, Lorenzo Montero, VI, Mexico D. F., Mexico	9 White Street
Getchell, Nelson Fletcher, IV, Lowell, Mass.	75 Pine Street
Grossman, Clinton, IV, Providence, R. I.	Sigma Omega Psi House
Hardy, Thomas Wadsworth, IV, Lowell, Mass.	30 Chauncey Avenue
Harpoot, Burgess Charles, VI, Lowell, Mass.	185 Liberty Street
Hatch, Robert Clinton, VI, Shirley, Mass.	———
Hobson, Charles Foster, Jr., IV, Lowell, Mass.	115 Butman Road
HoLem, Charlie, VI, Calgary, Alberta	156 Methuen Street
Howard, Winfield Hersey, IV, North Chelmsford, Mass.	———
Janes, Harold Earle, IV, Haverhill, Mass.	———
Kaplan, Samuel Gilbert, IV, Lowell, Mass.	472 Wilder Street
Kaplan, Sidney Stuart, VI, New York, N. Y.	43 Plymouth Street
Kelakos, Charles George, VI, Lowell, Mass.	47 Lagrange Street
Kelly, Warren Thomas, VI, Lowell, Mass.	41 E Street
Kiszka, Boleslaw Kazimierz, IV, Lowell, Mass.	211 Lakeview Avenue
Klosowicz, Edward Joseph, VI, Lowell, Mass.	40 Read Street
Knight, Richard Greene Howland, Jr., VI, Fall River, Mass.	43 Plymouth Street
Kostrzewa, Stephen Peter, IV, Lowell, Mass.	7 Roosevelt Place
Lemieux, Robert Alphonse, IV, Lowell, Mass.	56 Third Avenue
Littlefield, Carl Richard, VI, Lowell, Mass.	69 Warwick Street
Lutz, Helmuth Erich, IV, Lowell, Mass.	7 Houghton Street
Lyons, James Francis, Jr., IV, Nashua, N. H.	———
McMahon, Martin Edward, IV, Lowell, Mass.	43 London Street
Mahoney, Joseph Healey, IV, Andover, Mass.	———
Murphy, Hubert James, IV, Lowell, Mass.	999 Princeton Street
Oliver, Roger Barton, VI, Lowell, Mass.	62 Glenwood Street
Olsen, Earl Edward, VI, Reading, Mass.	———
Page, Herbert Stanton, IV, Chelmsford, Mass.	———
Paige, Walter Hale, Jr., New Bedford, Mass.	137 Riverside Street
Ploubides, John Peter, IV, Lowell, Mass.	59 Varney Street
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Ritchie, Newell Baird, IV, Concord, N. H.	———
Rosenstein, Leo David, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Shapiro, Sidney, VI, Lowell, Mass.	29 Daly Street
Sheehan, Leo James, IV, Dracut, Mass.	———
Sood, George David, IV, Woonsocket, R. I.	115 Mt. Vernon Street
Thomas, Fred, VI, Holden, Mass.	65 Sterling Street
Tobin, Robert Thomas, IV, Lowell, Mass.	49 School Street
White, William Sayles, VI, Lowell, Mass.	29 Monadnock Avenue

Diploma Students

Class of 1935

Home Address	*Lowell Address*
Boynton, Bradford Lewis, II, Andover, Mass.	———
Jessen, Robert Frederick, I, Whitinsville, Mass.	Omicron Pi House
Shann, William Edwin, II, Putnam, Conn.	52 Colonial Avenue

Class of 1936

Dursin, Louis Jules, II, Woonsocket, R. I.	793 Merrimack Street
Elliott, Charles Henry, I, Leicester, Mass.	Omicron Pi House
Gould, Charles Edwin, II, Portland, Me.	52 Colonial Avenue
Stokes, Alfred Roscoe, II, Rumford, R. I.	11 White Street
Wilson, Raymond Bachmann, II, Pawtucket, R. I.	146 Parkview Avenue

Class of 1937

Bresler, Francis Woodrow, III, Bridgeport, Conn.	Sigma Omega Psi House
Fleming, John Harvey, II, Sanford, Me.	156 Methuen Street
Pease, Kilburn Gray, I, Greenville, N. H.	156 Methuen Street

Special Students

Athanasopoulos, Louis Peter, III, Lowell, Mass.	108 Adams Street
Barrows, Raymond Reed, A.B., LL.B., I, Brookline, Mass.	———
Baranowski, John, III, Lowell, Mass.	4 Joiners Court
Bliss, Dorothy Myrtle, III, Chelmsford, Mass.	———
Bogacz, John, III, Lowell, Mass.	53 Melrose Avenue
Cwiklik, John Edward, III, Lowell, Mass.	84 Common Street
Dalphond, Alphonse, III, Dracut, Mass.	———
Davis, Clayton Winslow, III, Dunstable, Mass.	———
Dick, Kenneth Paul, IV, Lowell, Mass.	22 Wetherbee Avenue
Dion, George Walter, I, Salem, Mass.	———
Doukszewicz, Joseph Francis, III, Lowell, Mass.	52 Whipple Street
Dunn, Austin Pember, VI, Shirley, Mass.	———
Harmon, Lucien Johnstone, III, Lowell, Mass.	145 Winthrop Avenue
Hirsch, Emanuel Herman, VI, Weehawken, N. J.	43 Plymouth Street
Hofmann, Paul Louis, III, Lawrence, Mass.	———
Johnson, Richard, I, Salem, Mass..	———
Leonard, William Wheeler, Jr., IV, Norwich, Conn.	Omicron Pi House
LeVeen, Edward Phillip, Jr., II, Woodhaven, N. Y.	Hotel Marlborough
Liebmann, Herman, I, New York, N. Y.	43 Plymouth Street
Olney, Richard Holden, B.S., III, Lowell, Mass.	118 Riverside Street
Raymond, Gardner Lawrence, III, Bedford, Mass.	———
Reed, Grace Corbett, B.A., III, Reading, Mass.	———
Rogers, Harry David, II, Oak Park, Ill.	Omicron Pi House
Salpas, Cosmos George, III, Lowell, Mass.	232 Adams Street
Scharschmidt, Eugene Herman, III, Providence, R. I.	137 Riverside Street
Shaw, Charles Russell, IV, Methuen, Mass.	———
Stevens, Dexter, Jr., VI, Warwick Neck, R. I.	123 Riverside Street
Wasiuk, Joseph, III, Madison, Me.	226 Riverside Street
White, Walter William, III, Haverhill, Mass.	———

ALPHABETICAL LIST OF GRADUATES

The following list has been corrected in accordance with information received previous to February 1, 1935. Any information regarding incorrect or missing addresses is earnestly solicited.

B.T.C. indicates the degree of Bachelor of Textile Chemistry; B.T.D. indicates the degree of Bachelor of Textile Dyeing; B.T.E. indicates the degree of Bachelor of Textile Engineering; D indicates a diploma; C indicates a certificate (covering a partial course only). Degrees were issued beginning with the year 1913.

Abbot, Edward Moseley, II, '04 (D). Manufacturer, Abbot Worsted Company, Graniteville, Mass.
Abbott, George Richard, II, '08 (D). Andover, Mass.
Adams, Floyd Willington, VI, '16 (B.T.E.).
Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.
Adams, Tracy Addison, IV, '11 (D). Vice-President and General Manager, Arnold Print Works, North Adams, Mass.
Albrecht, Charles Henry, IV, '17 (B.T.C.). Chemist, Atlantic Mills, Providence, R. I.
Allard, Edward Joseph, IV, '31 (B.T.C.). Chemist, National Aniline & Chemical Company, Boston, Mass.
Allen, Grover Stanley, IV, '34 (B.T.C.). Chemist, The Gardiner Hall, Jr., Company, South Willington, Conn.
Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.
Anderson, Arthur Illman, IV, '24 (B.T.C.). Associate, Department of Research, Laundryowners National Association, Joliet, Ill.
Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City
Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Manville-Jenckes Company, Manville, R. I.
Anderson, Harold Robert, II, '26 (D). Research and Time Study Department, Abbot Worsted Company, Forge Village, Mass.
Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.
Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Dyer, Sayles Finishing Plants, Inc., Saylesville, R. I.
Arundale, Henry Barnes, II, '07 (D). Textile Analyst for G. H. Heath & Co., Ltd., Macclesfield, England, Andover, Mass.
Atwood, Henry Jones, II, '23 (D). Assistant Superintendent, Daniels Manufacturing Company, East Brookfield, Mass.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.
Babigan, Edward, IV, '33 (B.T.C.). 121 Bellevue Street, Lowell, Mass.
Babigan, Raymond, IV, '24 (B.T.C.). Associate Examiner, United States Patent Office, Washington, D. C.
Bachelder, Charles Edward, IV, '24 (B.T.C.) Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.
Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). With Wannalancit Textile Company, Lowell, Mass.
Bailey, Joseph W., I, '99 (D). Agent, Booth Manufacturing Company, New Bedford, Mass.
Bailey, Lester Harold, IV, '24 (B.T.C.). Chemist, United States Finishing Company, Pawtucket, R. I.
Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.
Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.
Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.

Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.

Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). With Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). Vice-President and Secretary, Walter Blue & Co., Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B.T.C.). Dyer, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Lawyer, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin, I, '00 (D). Second Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). Chemist, Hub Hosiery Company, Lowell, Mass.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beck, Frederic Christian, II, '24 (D). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). Textile Engineer, Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). With Calgon, Inc., Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, Frank P. Bennett & Co., 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Overseer of Dry Finishing, Glenark Mill, Woonsocket, R. I.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). 30 West Street, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Chemist, Armour & Co., North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Electrolux, Inc., Maywood, N. J.

Blake, Parker Gould, VI, '14 (D). District Manager, Claude Denis & Co., Ltd., Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). With Ludlow Manufacturing Associates, 80 Federal Street, Boston, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Salesman, The Huron Milling Company, Inc., 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Designer, Amoskeag Manufacturing Company, Manchester, N. H.

Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.

Bradford, Harold Palmer, II, '25 (D). 90 Beach Street, Malden, Mass.

Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.

Bradford, William Swanton, VI, '31 (B.T.E.). Assistant Superintendent, Dress Goods Division, Lawrence Manufacturing Company, Lowell, Mass.

Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.

Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.

Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.

Brainerd, Carl Emil, IV, '20 (B.T.C.). Superintendent of Dyeing, F. C. Huyck & Sons, Albany, N. Y.

Brandt, Carl Dewey, VI, '20 (B.T.E.). Head of Textile Engineering Department, Texas Technological College, Lubbock, Texas.

Brannen, Leon Vincent, III, '07 (C).

Brickett, Chauncy Jackson, II, '00 (D). Director, School of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.

Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.

Bridges, Herbert Gardner, II, '34 (D). Hill Road, West Newbury, Mass.

Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears & Co., 65 Worth Street, New York City.

Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.

Brosnan, William Francis, IV, '27 (B.T.C.). Superintendent of Dyeing, Bradford Dyeing Association, Bradford, R. I.

Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.

Brown, Philip Franklin, II, '23 (D). Manager, Special Products Section, DuPont Rayon Company, 350 Fifth Avenue, New York City.

Brown, Rollins Goldthwaite, IV, '12 (D).

Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.

Brown, Will George, Jr., IV, '22 (B.T.C.). Chemist, American Hide & Leather Company, Lowell, Mass.

Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.

Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.

Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.

Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.

Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.

Burke, James Edward, Jr., IV, '34 (B.T.C.). 77 Durant Street, Lowell, Mass.

Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous Company, Lawrence, Mass.

Burns, Robert, IV, '28 (B.T.C.). Chemist, Celanese Corporation of America, Amcelle, Md.

Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.

Buzzell, Harry Saville, VI, '29 (B.T.E.). Color Technician, Oxford Paper Company, Rumford, Maine.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

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Carleton, Joseph Raddin, III, '30 (D). Assistant Designer, The Bridgeport Coach Lace Company, Bridgeport, Conn.
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Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.
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Coffey, Daniel Joseph, III, '28 (D). Quality Man on Blankets, F. C. Huyck & Sons, Rensselaer, N. Y.
Cohen, Arthur Edward, IV, '23 (B.T.C.).
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Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.

Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.

Rice, Josiah Alfred, Jr., III, '20 (D). Manager, Wholesale Ginghams & Wool Goods, Marshall Field & Co., Chicago, Ill.

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Rivers, William Anthony, II, '24 (D). Resident Agent, Metropolitan Life Insurance Company, Woodstock, Vt.

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Roberson, Pat Howell, I, '05 (C). Vice-President, Union State Bank, Pell City, Ala.

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Robson, Frederick William Charles, IV, '10 (D).

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Sawyer, Richard Morey, VI, '27 (B.T.E.). (M.S., 1929, Massachusetts Institute of Technology.) Cost Engineer, Firestone Cotton Mills, New Bedford, Mass.

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Schneiderman, Jacob, III, '27 (D). Golf Professional, Flagler Golf and Country Club, Hotel Flagler, Fallsburg, N. Y.

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Schwarz, Herman Louis, IV, '22 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.

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Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C). 801 Bridge Street, Charlevoix, Mich.

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Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.

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Shedd, Jackson Ambrose, III, '28 (D). Designer, S. Stroock & Co., Newburgh, N. Y.

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Shenker, Nahman, III, '25 (D).

Sidebottom, Leon William, IV, '11 (D). Chemist, Boston Blacking & Chemical Company, East Cambridge, Mass.

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Slamin, Alfred Francis, I, '26 (D). Representative, Benjamin Franklin Paint Company, Philadelphia, Pa.

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Thompson, Henry James, IV, '00 (D). 15 Greenleaf Street, Malden, Mass.
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Toepler, Carl, IV, '22 (B.T.C.). Chemist, Bellman Brook Bleachery Company, Fairview, N. J.
Toher, Francis Luke, IV, '32 (B.T.C.). 58 Concord Street, Providence, R. I.
Topjian, Leon, IV, '30 (B.T.C.).
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True, William Clifford, II, '22 (D). Industrial Engineer, Chelsea Fibre Mills, Inc., Brooklyn, N. Y.
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Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Portsmouth, N. H.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.
Varnum, Arthur Clayton, II, '06 (D). Superintendent, Troy Blanket Mills, Troy, N. H.
Villa, Luis Jorge, IV, '25 (B.T.C.). Automobile Dealer, Hijos de Vicente, B. Villa & Co., Medellin, Colombia, S. A.

Villa, William Horace, VI, '24 (B.T.E.). Textile Engineer, Compania Colombiana de Tejidos, Medellin, Colombia, S. A.

Villeneuve, Maurice Arthur, II, '26 (D). With Killingly Worsted Mills, Danielson, Conn.

Vincent, William Henry, III, '26 (D).

Walen, Ernest Dean, VI, '14 (B.T.E.). General Manager, Pacific Mills (Worsted Division), Lawrence, Mass.

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Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.

Walker, Raymond Scott, II, '23 (D). Engineer, Wood Mills, Lawrence, Mass.

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Wallace, Joseph Max, IV, '31 (B.T.C.).

Wang, Chen, IV, '23 (B. T. C.).

Wang, Cho, VI, '23 (B.T.E.).

Wang, Tung Chuan, VI, '23 (B.T.E.).

Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.

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Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

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Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.

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Woodies, Ida Alberta, IIIb, '00 (C). See Shananquet, Mrs. Lee.
Woodman, Harry Lincoln, I, '02 (C). Assistant Superintendent, Construction, Merrimac Chemical Company, Woburn, Mass.
Woodruff, Charles Beauregard, I, '06 (C).
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Wotkowicz, Michael Joseph, VI, '20 (B.T.E.).
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Wu, Tsung-Chieh, VI, '25 (B.T.E.).
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LOWELL TEXTILE INSTITUTE

APPLICATION FOR ADMISSION

THIS SHOULD BE FILLED OUT AND SENT TO THE REGISTRAR

Date......................

Name in Full..

Date and Place of Birth...

Home Address ....
City or Town *State*

....
Street and Number

INDICATE COURSE DESIRED

DEGREE COURSES

IV. Chemistry and Textile Coloring

VI. Textile Engineering

1. General Course
2. Cotton Option
3. Wool Option
4. Design Option
5. Sales Option

DIPLOMA COURSES

I. Cotton Manufacturing

II. Wool Manufacturing

III. Textile Design

Graduate of..........................High School, Year 193......

Other High or Preparatory Schools attended........................

If you have done collegiate work, give name and address of college or university ....193...—193...

Signature ....

Signatures of...

Parents or Guardian...

Citizen of ....
City or Town *State*

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FROSTED WOOL*

Research in Refrigeration Applied to Removal of Raw-stock Impurities

By Edgar H. Baker, Professor of Textiles

"Frosted Wool" is the name given to the newly discovered process which eliminates substantial and worthwhile amounts of grass, burrs, seeds, chaff, shive, pitch, tar, paint, grease, and earth impurities from sorted grease wool (sheared or pulled) and other similar animal fibers. The process is based on the established fact that the natural oily grease with which wool and similar animal fibers are lubricated by nature during growth will congeal and become solid at certain temperatures below zero, Fahrenheit.

In this congealed or frozen state the wool grease is dry, hard, and brittle, and not greasy or sticky, and is shattered to dust by mechanical agitation. The frozen fibers can then separate one from the other and permit the vegetable matter to be thrown out through the screen of a duster. The oil in oil-branding paints will also freeze and, when frozen, will make the paint brittle or friable. When in this state the paint acts very much like the frozen grease and can easily be shattered and eliminated by mechanical agitation.

It is well known to wool men that wool fiber in the grease is not damaged by being subjected for long periods of time to subnormal temperatures. It is also a matter of common knowledge that clean wool, or any clean-wool product, is not damaged by freezing.

The problem of freeing sorted wool and other similar fibers, while in the grease, from the natural impurities produced by the animals themselves has always been easily solved.

Neither the scouring nor the naphtha process, however, will eliminate the vegetable matter, or the pitch, tar, or paint, if any or all of these unnatural impurities are present. Paint or tar used for branding the animals can be clipped from the paint sort made by the sorter—a method which is expensive, wasteful, and never entirely successful. Depainting and depitching can be done on the scoured wool or noils by passage through a bath containing a suitable solvent; but the process, while effective, is very expensive. Vegetable matter can be substantially eliminated from wools, noils, or fabrics, by carbonizing; but this method is expensive and harmful to the product, and wherever used is acknowledged to be a necessary evil. Depainting, depitching, and carbonizing are chemical processes which require elaborate and expensive equipment with high maintenance charges.

Burr-picking machines are commonly used for removing vegetable matter from woolen wools; and burring devices, such as burr guards, Morrel rolls, and Harmel rolls, are commonly used on worsted cards for removing vegetable matter from combing wools. But the fiber is damaged by all such devices; and the by-products produced contain excessive amounts of vegetable matter mixed with fiber, which must be eventually removed.

That the burring devices on worsted cards do not entirely eliminate vegetable matter is very evident from a casual examination of the card sliver. That there is nothing on any backwasher or gill box to remove vegetable matter is evident from examination of the material entering the combs. That all the vegetable matter in the material entering the combs, such as the Noble, Holden, French, Lister, and hybrid combs is not transferred to the noil is evident from the age-old custom of counting and reporting the number of pieces of vegetable matter, as well as neps, in 5 yards of finished top as a measure of quality of the combing, with definite standards and tolerances as to what constitutes a good delivery. That the vegetable matter in top does not all fall out, or is not thrown out, in drawing and spinning, or in any of

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the subsequent processes in worsted-fabric manufacture, is the sole reason for the expensive hand-specking, speck-dyeing, carbonizing, or penciling in the piece. Some noils and recombing noils may be free enough to be used in certain woolen fabrics or products, but too often they require carbonizing and depainting.

The modern burr picker for woolen wools breaks the fiber and does not remove all the vegetable matter. An examination of the card strippings, droppings, and burr waste from woolen cards and the yarn from mules and frames proves this. Worsted wools are never burr-picked because of the increased noilage produced.

A small amount of vegetable matter is permissible in some woolen fabrics; but its discernible presence is prohibited in the majority of fabrics, which must be hand-specked, speck-dyed, penciled, or carbonized to conceal or remove it. Vegetable matter can be hidden or disguised by speck-dyeing, which can be used on piece dyes only, and this concealment is a subterfuge and a mild form of fraud; or it can be painfully and patiently picked out of the finished fabric by hand, piece by piece, which is the most costly of all methods. The fact that hand-specking is done at all is proof of the lack of success of any of the other existing methods of removing vegetable matter.

The logical place to eliminate vegetable matter, paint, or tar is at the beginning and not at the end of the many processes of manufacturing woolen and worsted products.

Whether the sheep are range, barn, paddock, or pasture fed, the wool will contain vegetable matter, although the amount and character may vary extremely. Naturally vegetable matter differs in different countries and different parts of the same country. In general, however, it may be divided into grasses, seeds, parts of seeds, weeds, and burrs.

Some of the burr-bearing plants have excellent food value for sheep but from a manufacturer's standpoint they are all pests.

The ordinary cockle burr and the bean burr are hard and easily removed when few in number, but they are a menace to the wool grower and greatly detract from the value of the wool when they literally plaster the whole fleece. The spiny cockle burr, yellow-star thistle burr, horehound burr, star burr, sand burr, trefoil burr, and burr clover (mestiza or spiral burr) are all pests, particularly the trefoil and mestiza. Wire grass, corkscrew grass, pip-gut or broncho grass, foxtail or squirreltail grass, the filarees (blue stem and red stem), and beggar lice, when present, automatically throw the wool down into the defective class.

The spiral or mestiza burr has been called the sheepman's best friend and worst enemy. It is the seed of the burr clover plant which will thrive and multiply on land on which practically nothing else will grow. It has a very high food value, and the sheep relish it. During the dry season the plants dry up and blow away, leaving the ground covered with the tiny burrs which the sheep eat. The presence in wool of the burrs is an absolute bane, as they will uncoil and straighten out in processing and appear in the ultimate fabric as an integral part of the yarn.

Alarmingly increasing amounts of splendid wool contaminated with these burrs come from California, Arizona, Texas, and other Southwestern States in the United States of America, South America, South Africa, and Australasia. Some of the foreign wools are so burry that they are rarely imported into the United States, being sold to manufacturers in Bradford (England), France, and Belgium, who are skilled in reclaiming the fiber.

Range sheep in some of our Northwestern States, like the Dakotas, Montana, and Wyoming, spend their whole life in the open, exposed to the elements and prolonged temperatures ranging from 120° F. in summer to 60° below

zero in winter. The annual clip from these four States averages more than 80 million pounds of which, several million pounds are frequently stored in unheated barns and sheds for one or more years, because of no market, or in anticipation of a more favorable one before being shipped to the Eastern wool merchants. There is no evidence of damage to the wool by these repeated freezings and thawings, either while on the sheep's back or in storage. Some of the stored fleeces may be damaged by moths or other vermin, but not by freezing, as the wool fiber itself cannot be frozen and extreme low temperatures have no effect on its physical structure or chemical composition.

This fact has been verified and checked by one of America's outstanding microscopists who has examined the cells in the inside and the scales on the outside of many fibers subjected to the Frosted Wool Process and has compared these fibers with untreated fibers. As the result of his examination, he has certified to the fact that the Frosted Wool Process produces no change in the physical structure of the fiber.

While the process does not remove all the grease, vegetable, or other foreign matter from grease wool and must in most cases be followed by scouring, degreasing, and washing, to produce commercially clean wool, it does eliminate before beginning the usual mechanical processing from 30 to 90% of the total normal shrinkage of the grease wool, which includes from 60 to 94% of the vegetable matter (Figs. 1, 2, and 3) and from 30 to 70% of the grease (Fig. 4).

Frosted grease wool after being scoured has a much better color than the ordinary scoured wool; and naturally the top, noil, yarn, and fabrics have better color. Wool which is normally cream or yellow white becomes a blue white and in many cases appears to have been bleached or blued. This change in color is not a chemical one, but is due wholly to the fact that the outside of the fiber has been freed of grease and filth and does not retain the stain which is present in the ordinary scouring liquors.

The principle of the process is very simple. The machinery is not complicated and consists of any standard refrigerating unit and a refrigerating room containing all the cleaning machinery (Fig. 5).

The refrigerating machine has a rated capacity of approximately 27 tons, which will produce and maintain an air temperature of about 35° below zero F., while the full load of from 1,000 to 1,500 pounds of wool per hour is being processed.

The refrigerating room (Fig. 5) is an inclosure 40 feet long by 12 feet wide and 12 feet high, with walls, ceiling, and floor of 9-inch cork. The equipment has been designed in such a way that, if desired, it can be installed in place of the first scouring bowl of a scouring train.

The grease wool is elevated and fed by a standard feeder to the top of the cold chamber, where it enters through a pair of sealing rolls, which exclude the warm air. The wool drops onto the freezing conveyor, which is 20 feet long, with coils above carrying the refrigerant and fans below for circulating the air through the coils and the wool. The wool remains on the freezing conveyor for a period of from 3 to 7 minutes.

At the end of the conveyor the wool drops onto the feed sheet of a specially designed and constructed intermittent batch duster (cleaning machine), in which it remains for a few seconds. The frozen foreign matter is thrown out of the wool through screens in the duster and is carried away and discharged from the room by a continuously operating conveying system. The cleaned fiber is intermittently discharged from the duster and taken away by a condenser, which drops the wool into sealing rolls through which it is discharged from the cold room without the loss of cold air. This duster cannot and will not roll or knot the wool.

The screens do not become clogged with grease or fiber, due to the dry state of the materials at this low temperature.

No operator is required in the freezing chamber during the processing, as the machines are synchronized and equipped with automatic stop motions. The period of treatment in the cleaning machine, which is determined by the character and quantity of vegetable matter and other impurities, the character of the wool, and the results sought, can be instantly changed by a control located in any desired place outside of the chamber.

The material emerging from the Frosted Wool Process is dry and can be immediately scoured, bagged, stored, or shipped as if it were greasy or clean wool.

The process has not yet been commercialized for the treatment of noils, burr waste, or scoured wool.

As originally conceived, the Frosted Wool Process was expected to remove vegetable matter from scoured defective wools, while in the wet state; but as developed, the same final objective has been reached by treating the original grease wool, rather than scoured wool. The treatment of grease wool has the added advantage of removing, in addition to vegetable matter, substantial amounts of other foreign matters, such as grease, paint, pitch, tar, and earth impurities from the wool before it enters the scouring bowls or degreasing and washing plant; thus enlarging the scope of the process to make it applicable not only to defective wools, but also to all so-called free wools and wools which require special treatment before they can be scoured, such as cotted fleeces, cotts, etc.

The development and perfection of the Frosted Wool Process (a trade name) has been carried out at the Lowell Textile Institute during the last three years. The work has involved the use of the research facilities of the Institute in developing the machinery and in determining the effect of the Frosted Wool Process on all the physical properties of wools. A full commercial-size Frosted Wool cleaning unit, having a capacity of from 1,000 to 1,500 pounds of grease wool per hour, was installed in the Institute last year and is now in operation.

During the last year about 500,000 pounds of grease wool, containing various kinds and amounts of vegetable matter in grades ranging from carpet to 72s cape, in lots of from a few bags to 20,000 pounds, have been treated by the Frosted Wool Process in this unit and returned to the mills for converting into clean wool, top, yarn, woolen and worsted fabrics and hardened felt.

In practically all cases duplicate lots of wool were kept by the mills and processed in the usual manner for the purpose of developing comparative data. Careful records were kept of general quality, yields, shrinkages, amounts, and values of products and by-products, strengths, staple length, vegetable matter, dyeing quality, handle, color, costs, economies, etc. Several examples of these data are given in the table on Page 6.

The total operating cost of the Frosted Wool Process including depreciation but not including royalty, is less than one-half of a cent per pound on the weight of the wool to be processed.

From the very complete line of samples and results received from the mills covering these tests, and the exhaustive data and samples accumulated during the thousands of tests made in developing the Frosted Wool Process, the following advantages have been and can be demonstrated:

1. In the final analysis, from grease wool to finished fabric, using free wool, defective wool, or off sorts, alone or in combination the question of the use of the Frosted Wool Process as compared with the usual method of processing, is solely one of economic balance, with the difference very positively in favor of the Frosted Wool Process.

2. In scouring alone, the amount of water, soap, alkali (if used), steam, time required, and pollution of the scouring liquor is materially reduced. In the case of some carpet wools so much grease and foreign matter are removed that the scouring process can actually be omitted.

3. All noils have increased in value due to the lessened vegetable, paint, and other foreign-matter content, and most of them can be used for woolen woven products and hardened felts without carbonizing.

4. All tops have the vegetable-matter count materially reduced, in some cases almost to the vanishing point.

5. All top and noil have better color and feel, and top has more bloom.

6. All yarns, both worsted and woolen, show greater elongation before reaching the breaking point.

7. Yarns made from Frosted Wools show greater uniformity in breaking strength, with less variation between the maximum and minimum breaks, than regular yarns made from the same wools.

8. Some wools, yarns, and fabrics show deeper color when dyed, with the same amount of dyes and chemicals.

9. Specking is reduced or eliminated; and speck-dyeing is used only to cover cotton or artificial silk picked up in processing, if used at all.

10. The felting or fulling property of the wool is not affected by the process.

11. The pollution of streams from waste-scouring liquors is reduced.

12. There are intangible savings in maintenance of scouring, carding, combing, and spinning machinery and in general processing.

13. Low-priced defective wools are converted into equal or better than free wools as far as vegetable matter is concerned at low cost and with little or no damage to the fiber.

14. The process is equally applicable to wools for the woolen, worsted, felt, and carpet industries.

Comparative Results of Regular Wool Treatment and Frosted Wool Treatment of Identical Lots of Wool.

	62s Blend		56s Blend		¼ Blood	
	Untreated %	Frosted %	Untreated %	Frosted %	Untreated %	Frosted %
Grease Wool	100.00	100.00	100.00	100.00	100.00	100.00
Vegetable Matter	.66	.66	.88	.88	2.13	2.13
Wool after Frosting	—	71.40	—	70.50	—	79.00
Vegetable Matter in Frosted Wool	—	.25	—	.14	—	.62
Carding						
Waste Dusted	.65	.71	.84	.67	1.96	1.94
Strips Dusted	.30	.27	—	—	.27	.26
Burr Dusted	.54	.60	.55	.55	.89	.84
Comb Bits	.05	.03	—	—	.61	.54
Total Waste	1.54	1.61	1.39	1.22	3.73	3.58
Noils on Gr. Wt.	4.62	5.01	3.20	4.07	6.70	6.50
Top on Gr. Wt.	29.54	29.32	40.89	40.28	40.20	41.00
Total Usable Fiber	35.70	35.94	45.48	45.57	50.63	51.08
Vegetable Matter in 5 Yd. Top	66 Pcs.	18 Pcs.	92 Pcs.	15 Pcs.	137 Pcs.	49 Pcs.

Note: Practically all pieces of vegetable matter in treated top are less than 3/16″ long.

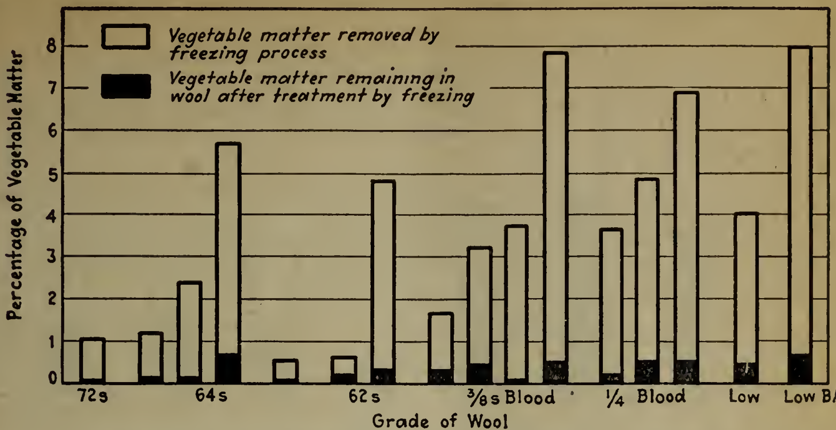


FIG. 1 - Vegetable Matter in Typical Wools Before and After Treating by Frosted Wool Process

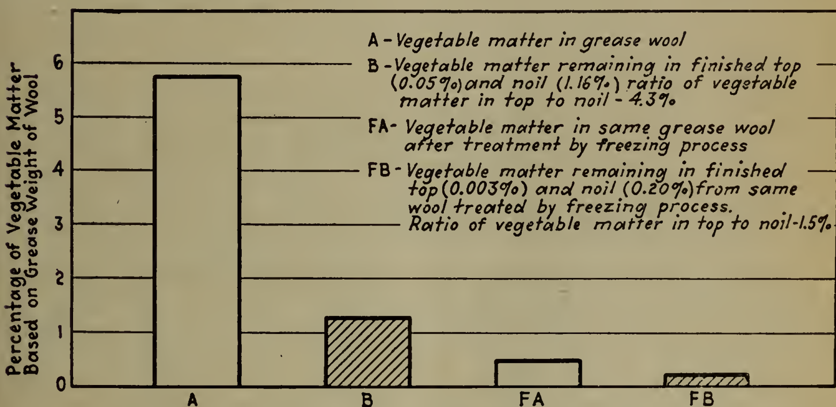


FIG. 2 - Effectiveness of Removing Vegetable Matter by Freezing Process

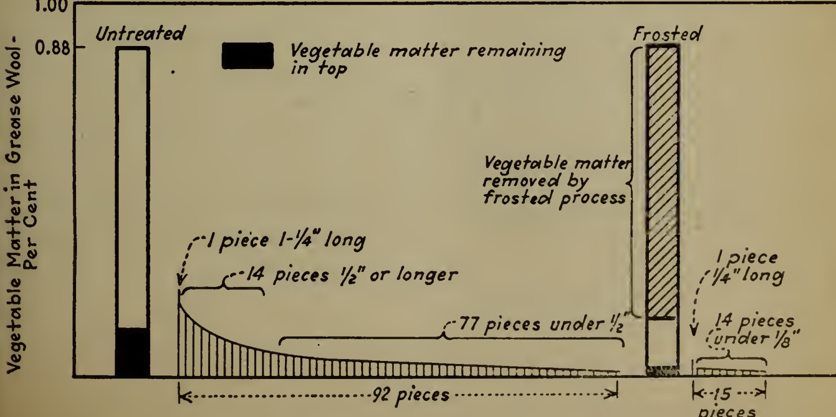


FIG. 3 - Number of Pieces in 5 yd. of Top from 3/8s Domestic Wool

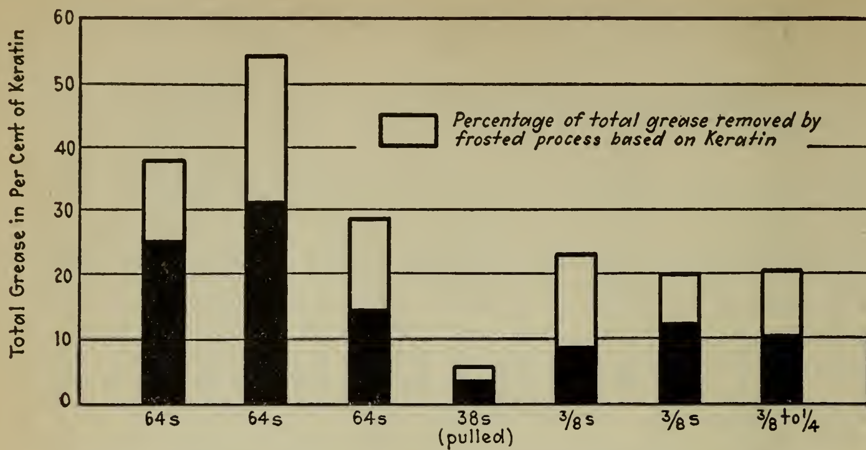
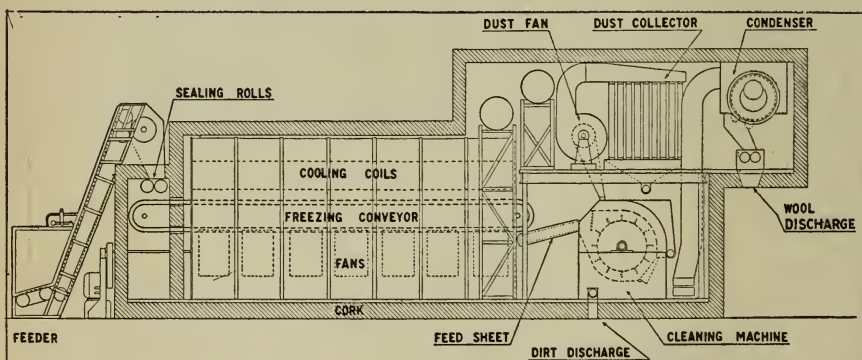


FIG. 4- Grease Removed from Several Typical Wools by Frosted Wool Process



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LOWELL, MASS.

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Moody Street and Colonial Avenue

DEPARTMENT
OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document approved by the Commission on Administration and Finance
2M. 8-'35. Order 5226.

LOWELL EVENING TEXTILE SCHOOL.

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1935.

September 26, Thursday	Registration.
October 3, Thursday	Registration
October 7, Monday	Opening of evening school.
November 11, Monday	Armistice Day—Holiday.
November 28, Thursday November 29, Friday	Thanksgiving recess. No classes.
December 20, Friday	End of first term.

1936.

January 2, Thursday	Opening of second term.
March 6, Friday	Closing of evening school
April 7, Tuesday	Graduation.

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Glen Bowden Caswell, ... 32 Hampshire Street.
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Inez L. Keller . . . . 8 Orchard Street.
Evening Instructor in Art.
Ivar O. Moberg . . . . 35 Thirteenth Street.
Evening Instructor in Weaving.
Dorothy M. Bliss . . . . Chelmsford.
Evening Instructor in Design.

EVENING CLASSES

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

110. Cotton Yarns—2 Years.

Because of the desire of students to be able to complete the course in Cotton Yarns in less than three years, the schedule has been rearranged to complete the work in two years. If a sufficient demand develops for additional work, it may be possible to add a course on Mill Organization which will follow the course in Cotton Yarns.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used and the production of each process as well as the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the control of waste.

Two evenings each week.

Cotton.—Before taking up the details of manufacturing cotton into yarn, a careful study of its physical characteristics is made. The geographical distribution of the areas producing commercial cottons is explained and the characteristics of the cottons produced in each are studied. A general explanation of the cultivation and harvesting of cotton is made, especially emphasizing the effect of agricultural factors on the cotton fiber and how these may serve to complicate manufacturing problems.

The ginning of cotton is considered, showing the yield of lint, the uses of cotton seed and the various types of gins and which cottons are commonly ginned on each.

The intricate system of buying and selling cotton is studied to illustrate the problems a mill may meet in procuring cotton. In this connection, special emphasis is placed on the classification of cottons by staple, grade and character.

Opening and Picking.—Instruction in the preliminary operation of opening and picking covers the mechanical construction of the machines, their parts and adjustments, as fully as the manufacturing results accomplished by the machines. This includes such construction details as evener, lap measuring and safety stop motions, grids, cleaning trunks and beaters, also operation details which involve the adjustment for waste, drafts and character of laps. Some time is devoted to mixing in its various phases, showing in addition to improvement in uniformity of the product, how cottons are mixed to obtain definite average prices and how different percentages of color may be obtained by mixing, expecially on the pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, spooling, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper attention is paid to such subjects as stop motions, drawing rolls and their covering, clearers and evener motions.

Roving Process.—Under this head are studied the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use.

Ring Spinning.—The consideration of spinning yarn by the ring frame method involves a knowledge of the uses to which the yarn is to be put and subsequent methods of handling, that proper roving may be selected, suitable amounts of draft and twist provided, correct size of rings and travelers selected, and building motions suitably adjusted. Yarn defects are studied with reference to the cause and remedy, necessitating references to many of the earlier operations.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns is taken up here. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

WOOLEN AND WORSTED DEPARTMENT.

210. Worsted Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc., also a course in carding and the calculations involved in the mechanism of the machines, and a course covering gilling and combing and the processes of top making.

Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk,

mohair, alpaca, vicuna, cashmere, camel's hair and cotton. In connection with these are considered shoddy, noils and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture. The various characteristics and properties are explained, as are also trade terms, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of soaps and chemicals used in washing; also the waste products and their utilization. A demonstration of a commercial quantity of wool is scoured by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap. At the same time the use of driers, their operation and regulation, is taken up, and the methods of carbonizing wool, noils, burr waste, rags, etc., are studied and explained.

Carding.—The different systems of carding wool, depending on whether it is to be made into woolen or worsted yarns, are fully explained, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application and grinding.

Top Making and Combing.—This branch takes up, besides the carding of the wool on a worsted card, the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures. Later, quantities of stock are made into top and then into yarn.

Three evenings each week.

The *second year* is devoted to detail study of the English and French systems of worsted yarn manufacture.

The Noble, Lister and French combs are studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

211. Woolen Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc.

One evening each week.

The *second year* covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Two evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Com-

bination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in

the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, cloth and other materials of particular interest to the textile chemist, special lecture notes and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT

510. English Composition—2 Years.

Remedial English and Rhetoric—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

Problems in the Interpretation and the Appreciation of Literature—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

For one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint, the course in Mechanical Drawing is offered. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

This course is a complete course in drawing and requires *two evenings per week* for three years for its completion. The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete. The time required is *two evenings each week.*

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires attendance *two evenings each week* with home problem work and the study of a text book.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further by evening study the mathematics of his grammar or junior high school course. It includes algebra, elementary trigonometry, logarithms and slide rule, and requires attendance for *two evenings each week.* It should be taken by all who intend to study further into engineering subjects. Instruction is largely through problem work in class and at home, and the use of a text book.

Some of the topics treated are—

Elementary algebraic operations of—

Addition.
Subtraction.
Multiplication.
Division.
Factoring.
Fractions.
Graphical representation.
Linear equations.
Radicals.
Quadratic equations.
Logarithms.
Slide rule.
Trigonometry

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron,. steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The time required is *two evenings each week* and the method of instruction is through lectures, recitations, problems, and the use of a text book.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used, requiring an attendance of *two evenings each week.*

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. It requires for its completion attendance for *two evenings each week* and a considerable amount of home study and preparation. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work. An attendance of *two evenings each week* is required.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated.

A test book is required and the class is held *two evenings each week.*

626. Mill Illumination—1 Year.

Because of the demand by mill men, this course is now offered to evening students and requires an attendance of *two evenings each week.*

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

629. Selling, Advertising, and Marketing—1 Year.

An elementary course designed to acquaint the student with the principles involved in the distribution and merchandising of textiles and other commodities.

The course is given in two parts. One evening a week the principles underlying salesmanship and advertising are studied. The other evening is devoted to a study of marketing principles and practice. Both parts must be taken in order to secure a certificate.

The selling and advertising section deals with the psychology of selling and advertising, copy writing, layout, illustrations, mechanical requirements of copy and illustration, advertising campaigns, personality, types of customers, the selling process, dramatization, etc.

The marketing section covers modern methods of distributing goods with special emphasis on the textile industry. The functions and importance of selling agents, brokers, converters, wholesalers, factors, retailers and other intermediaries in the channels of distribution are studied as well as the fundamentals of styling, market research, pricing, forecasting, retailing, wholesaling, and other pertinent topics.

The material is presented by means of lectures and class discussions and assigned problems. An attendance of *two evenings each week* is required.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. The requirements are attendance *two evenings each week* with home problem work and the study of a text book.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In these courses machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. These courses also help the finisher to broaden his knowledge of textile fabrics. Attendance is required for *two evenings each week.*

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and num-

bering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for

example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

711. Cotton Finishing—1 Year.

The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the objects thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types, and for various purposes; the use of cooling tanks, steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing; the use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustment of various types.

Water Mangles.—Their object and construction of various types; various rolls,—iron, husk, etc., scutchers, their object and construction.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls,—brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical, tenter frames, clips; the swing motion and the finishes thus produced; construction; spraying machines, belt stretchers, button breakers; their object and construction.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk and paper; the use of hot and cold rolls; chasing, friction, embossing and Shriner calenders and the various finishes produced by each; production of watered effects; beetling machines.

Making up room,—yarding, inspecting; different types of folds; pressing, papering, marking.

Two evenings each week.

EVENING GRADUATES OF 1935.

Certificates awarded as follows, April 23, 1935:

Cotton Yarns—2 Years.

William Endicott, 2nd	Lowell
Elwyn Warren Mitchell	Methuen
Perley Hill Shaw	Nashua, N. H.
George Simpson	Andover
Herbert MacWhinnie Weymouth	Nashua, N. H.

Knitting—2 Years.

James William Scott	Everett
Alfred John Traverse	Lowell

Woolen Yarns—2 Years.

Frederick Darlington	Lawrence
Henry Francis Drenth	Methuen
Joseph Kieva	Methuen
Hubert Gerald McAnespie	Dracut
Raymond Thomas McDonagh	Lowell
Richard Holden Olney	Lowell
Daniel Maurice Seamans	Lowell
Otho Wilton Tompkins	West Concord

Worsted Yarns—2 Years.

John Rostron Berwick	Andover
Joseph Harper Binns	North Andover
Joseph Frederic Burtt	Lowell
Lawrence Greenfield	Methuen
George Frederick Hemas	Lawrence
Joseph Jacob Kisiolek	Chelmsford
Charles William Kobos	Lawrence
Edward Everett Maddocks	Lowell
Francis Jerome Mahoney	Lawrence
George Sumner Orr	Methuen
Herman Robert Schmottlach	Methuen
James William Stott	Methuen

Cotton Design—3 Years.

Joseph Adam Lacerte, Jr.	Lowell

Woolen and Worsted Design—3 Years.

Edgar Wallace Birdsall	Malden
Thomas Bernard Casey	North Billerica
Percy Horace Helie	Worcester
Archie McKellar Smith	Manchester, N. H.

Advertising Design—2 Years.

Doris Rachel Atkinson	Lowell
Robert Joseph Carmody	Wilmington
Emma Clarke	Lowell
Albini Alfred Dufresne	Lowell
Henry Lucien Gauthier	Lowell
Roy Elgin Hardy	Pelham, N. H.
Paul Henry Hirbour	Lowell
Eleanor Beatrice Ingalls	Lowell
Peter Joseph McErlane	Lowell

Clement Alphonse Miron	Lowell
Jasper Jerry Pechner	Lowell
Dorothy Isabel Scott	Lowell
Rita Theresa Sullivan	Lowell
Sidney Ellsworth Vining	Pelham, N. H.
Daniel Joseph Wholey	Lowell

Decorative Art—3 Years.

Patricia Gertrude Cormier	Lowell
Charlotte Eleanor Evirs	Lowell
John Patrick Finn	Lawrence
Lillian Agnes McKenna	Lowell
Robert Douglas Weymouth	Lawrence
Edith Auriel Williams	Lowell

Cotton Weaving—1 Year.

Joseph Frank Bobusia	Lowell
Philip Little Carlman	Salem
Mary Constantis	Lowell
William Cuipa	Lowell
Peter Samuel Dolly	Lowell
Thomas Kinlock Fretwell	Lawrence
Charles Joseph Gibadlo	Lowell
Heman Burns Hunter	Salem
Oscar Jardin	Lowell
Walter Stanley Kowalski	Lowell
Claire Lillian Lajeunesse	Lowell
Wilfred Avila Lepine	Lowell
Joseph Domingos Pereira	Lowell
Raymond Alcide Sevigny	Lowell
Joshua Kay Stalker	Lowell
Romeo Eldhege Touzin	Lowell
Stanley Wroblewski	Lowell
Clara Zouvelos	Lowell
Vasilo Zouvelos	Lowell

Woolen and Worsted Weaving—1 Year.

Henry Jules Bourgeois	Lowell
Richard Augustine Burns	Lowell
Gerard Joseph Chenell	Lowell
Leopold Chenell	Lowell
Charles Edward Coffey, Jr.	North Billerica
David Alexander Stirling Doig	Andover
George James Dyer	Lowell
Albert John Germain	Lowell
Charles Joseph Gibadlo	Lowell
Joseph Charles Gibadlo	Lowell
Raymond Terrence Griffin	Lowell
Leo Grondine	Lowell
Donald Bernard Humphrey	Lawrence
Edward Joseph Jastrzab	Lowell
William Paul Jonis	Lowell
Benjamin Kalinowski	North Andover
Walter Daniel Kohanski	Lowell
Frank Valenty Krofka	Lowell
Fred Dean Manchester	Lowell
John David Manning	Lowell
William Martineau	Lowell
Christopher Lawrence Muller	Andover
Zenon Wardsworth Narkun	Methuen

George Edward Netto	Lowell
Stephen Paul Nida	Lowell
Lionel Theophile Pelletier	Lowell
Laurent Joseph Rioux	Lowell
Ernest Dobson Robinson	Methuen
Herbert Hodgson Robinson	Methuen
Joseph Narcisse Romeo Saucier	Lowell
Edgar Armand Seguin	Lowell
Martin Silva	Lowell
William Sybiak	Lowell
Joseph Robert Tousignant	Lowell
Rolland Carmel Vincent	Lowell
Clifford Rudolph Watson	Lowell
Stanley Tadeusz Zbieg	Lowell

Loom Fixing—1 Year.

William Lucien Carignan	North Billerica
Gerard Joseph Goudrault	Lowell
Adolph Joseph Johnson	Lowell
Patrick Joseph Keegan	Lowell
Thomas Harris Lauzon	Lowell
Joseph Michael Piekos	Lowell
Theodore Louis Piekos	Lowell
Francis Gordon Rodgers	Methuen

Cotton Finishing—1 Year.

Dryden Lawrence Ballantyne	Lawrence
Carl Herbert Kruschwitz	Methuen
Manuel Cunha Rosa	Methuen

Woolen and Worsted Finishing—1 Year.

David Eaton Arthur	Methuen
Vincent Murtaugh Borrows	Chelmsford
Charles Herman Appleby Dunker	Brookline
John Bain Gledhill	Methuen
James Arthur Kenyon	Lowell
William Aloysius Kulpinski	Lawrence
John Francis Martin	Lowell
Hiram Manly Metcalfe	Haverhill
John Bernard Moran	Methuen
Winford Sykes Nowell	Methuen
Leo Joseph Rollins	Lowell
Raymond Boyd Spence	Lowell

Elementary Chemistry—2 Years.

Richard Joseph Allen	Lowell
William Gray Bailey	Newton Highlands
Angelo John Boutselis	Lowell
Bernard Joseph Bresnahan, Jr	Methuen
John Cruickshank Burnett	Andover
Frank Leo Carr	Lowell
Angela Agnes Conlin	East Chelmsford
Najie Elias Daher	Lawrence
John Doulames	Lowell
William Arthur Drummond	North Andover
George Henry Ennis	North Billerica
Wilfred Alfred Findeisen	Methuen
James Lafayette Hart	Lawrence
Weldon Maxwell Huckins	Lowell
Harry Ralph Johnson	Lawrence

Harry Theodore Johnson	Lowell
Joseph Vincent King	Haverhill
Paul Bernard Klier	Lawrence
Harold Earl Knight	North Billerica
Ernest Albert Lehninger	Methuen
Arthur Charles McDonough	Lawrence
Sidney Robert Marsden	Methuen
John Erwin Martin	Lowell
John Joseph Morrison	Lawrence
James Edward O'Donnell	Lowell
Roger Merrill Peabody	Andover
James Harrison Rishton	Manchester, N. H.
James Francis Rourke	Lowell
George Rodney Schmottlach	Lawrence
John Smith	North Andover
Maurice Churchill Stanley	Lowell
Bernard Francis Tracy	Lowell
George Albert Tyler	Lowell
Anthony John Villani	Lawrence

Textile Chemistry and Dyeing—3 Years.

Harold Mudd	Lawrence
James Lamont Phillips	Andover
Joseph Usher Ryan, Jr.	Haverhill
Wilbur Lane Williams	Lowell

Analytical Chemistry—3 Years.

Edward Lawrence Dinneen	Lowell
Joseph Patrick Kenefick	Lowell

Alternating Current Electricity—2 Years.

Peter Anderson	Andover
Edward John Dunn	Lowell
Joseph Francis Finn	Lawrence
Arne John Mikkola	Lowell
James Allen Shanks	Dracut
Jack Thornton	Lowell
Michael Valentine Torla	Lawrence

Direct Current Electricity—2 Years.

William George Chapman	Lowell
Raymond Arthur Flanders	Methuen
Lucien Henry Haesebrouck	Lowell
Carl Alfred Henning	Methuen
Desmond Alexander McElholm	Lowell
Ronald Ernest Pray	Lowell
Ralph Emmons Tweed	Lowell

Mechanical Drawing—3 Years.

Thomas Edwin Banks	Lowell
Henry Joseph Brunelle	Lowell
Maurice Ludger Gauthier	Lowell

Machine Shop Practice—2 Years.

Arthur David April	Lowell
Real Emil Joseph Bolduc	Lowell
James Arthur Cashman	Lowell
John Crossley	Lowell
Glendon Wordsworth Donaghey	Lowell

Frank Gilbert Fowler	North Billerica
Charles John Hondras	Lowell
Gerard Pamphile Jean	Lowell
William Anthony McArthur	Lowell
Milton Arthur Robbins	Ayer
Casimir Francis Sperling	Lowell
Eugene Joseph Walsh	Lowell

Mathematics—2 Years.

Paul Albert Daigle	Lawrence
Arthur Leonard Dunnigan	Lowell
Harold Charles Griffin	Lowell
Arthur Haritos.	Lowell
Beatrice Theresa Hoar	Lowell
Edgar Russell Kay	Lowell
Hector Landry	Lowell
William Copp Newall	Lawrence
George Ormsby	Lowell
Roland Henry Thurber	Lowell

Steam—1 Year.

Julius Walter Amsiejus	Dracut
Wilfred Bottomley	North Andover
Theodore Chmura	Lawrence
Thomas Raymond Hoyle	Lowell
William Robertson Kiesling	Methuen
Paul Kotarba	Lowell
Maurice Henry Quinlan	Lowell

Selling and Advertising—1 Year.

Wilfred Leo Beauregard, Jr.	Lowell
Raymond William Berry	Lowell
Harold Dodge Buck	Lowell
John Kenrick Butler	Lowell
Robert Martin Chenevert	Lowell
Vernon Stanley Cook	Lowell
George Clarence Fairburn, Jr.	Lowell
André Henri Gervais	Lowell
Calman Hoffman	Lowell
Edward James Kennedy	Lowell
Donald Stevens MacInnis	Lowell
Hugh MacQueen	Lowell
Stephen Gerry Mansur	Lowell
Joseph Patrick Moynihan	Lowell
Mary Xavia Sullivan	Lowell

SERIES 39, No. 2

November, 1935

BULLETIN

OF THE

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Issued Quarterly

1935-1936

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Moody Street and Colonial Avenue

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2200—12-'35. Order 6236.

THE EFFECT OF REGAIN ON THE TENSILE STRENGTH AND ELONGATION OF VISCOSE RAYON YARN

by HARRY C. BROWN, S. B., *Assistant Professor of Physics*

The physical properties of textile fibers are affected by the amount of moisture absorbed by them. The amount of moisture present in fibers depends largely upon the relative humidity of the atmosphere provided that the time of exposure is sufficient to produce a condition of equilibrium in moisture content.

Investigations made by means of polarized light and X-rays indicate that both artificial and natural textile fibers have a definite crystalline structure. The crystals are arranged in chain-like formations or aggregates with the long axes approximately parallel to the fiber axis, and there is possibly an amorphous binding material between the chain groups. Viscose rayon filaments have shown a good degree of orientation with no spirality.[1]

According to one authority,[2] water may be held in combination with cellulose fibers in five different forms: (1) as water of the cellulose, (2) as capillary water, (3) as colloidal water, (4) as osmotically combined water, (5) as chemically combined water, or water of hydration. The presence of water in one or more of these forms probably weakens the force holding the chain-aggregates together or lessens the binding power of the non-crystalline material between the chains, resulting in a decrease in tensile strength and an increase in ultimate elongation in the case of rayon yarns.

The effect of regain upon the tensile strength and elongation of viscose rayon yarns was investigated by David J. Fox, 1934, as an undergraduate thesis, under the direction of Professor H. J. Ball, in charge of the Textile Engineering Department of the Lowell Textile Institute, and the data found in this bulletin are taken from that investigation.

Six different kinds of viscose rayon yarn were kindly furnished by a local mill for breaking strength-elongation tests. Five 120-yard skeins were prepared from each specimen of yarn and conditioned in a room equipped with a humidifier electrically controlled so that the humidity could be maintained constant within one and one-half per cent. Single strand breaking strength-elongation tests were made after conditioning for three hours in an atmosphere of constant relative humidity and temperature of 70° to 75° F. Tests were made at relative humidities of 35, 45, 55, 65, and 75 per cent. The humidities were selected so as to include the usual range encountered under working conditions and also to secure approximately equal increments of regain.

Tests were made by a single strand Schopper testing machine upon one hundred single yarns taken from each skein. The testing machine was of the pendulum type and was provided with an elongation scale giving the ultimate elongation in tenths of a millimeter. The initial distance between jaws was 25 cm., the speed of the pulling jaw was 12 inches per minute, and the initial load on the yarn was 10 grams. Portions of the broken yarn were weighed in order to determine the actual regain at the time of testing.

The averages of one hundred breaking strength-elongation tests at five different relative humidities upon six different specimens of viscose rayon are given in Table I.

Plots of regain and breaking strength indicate that decrease in breaking strength is approximately proportional to increase in regain. Plots of regain

[1] Morey, "Textile Research", Vol. IV, No. 11

[2] Matthews, "Textile Fibers", Page 352

and elongation show that the change in ultimate per cent elongation is approximately proportional to change in regain.

The effects of regain and relative humidity upon breaking strength and elongation are summarized in Table II. The rates of decrease in breaking strength given in Table II are based upon the tests of the first five specimens of viscose rayon yarns at the selected humidities. The rates of increase in elongation are based upon the tests of all six specimens.

Figure I shows the relation between regain and breaking strength of one of the specimens and very closely represents the average effect of regain upon the first five specimens. Figure I also shows the relation between regain and ultimate elongation for another specimen and very closely represents the average effect of regain upon the six different specimens.

TABLE I

AVERAGES OF
BREAKING STRENGTH-ELONGATION TESTS
OF VISCOSE RAYON YARNS

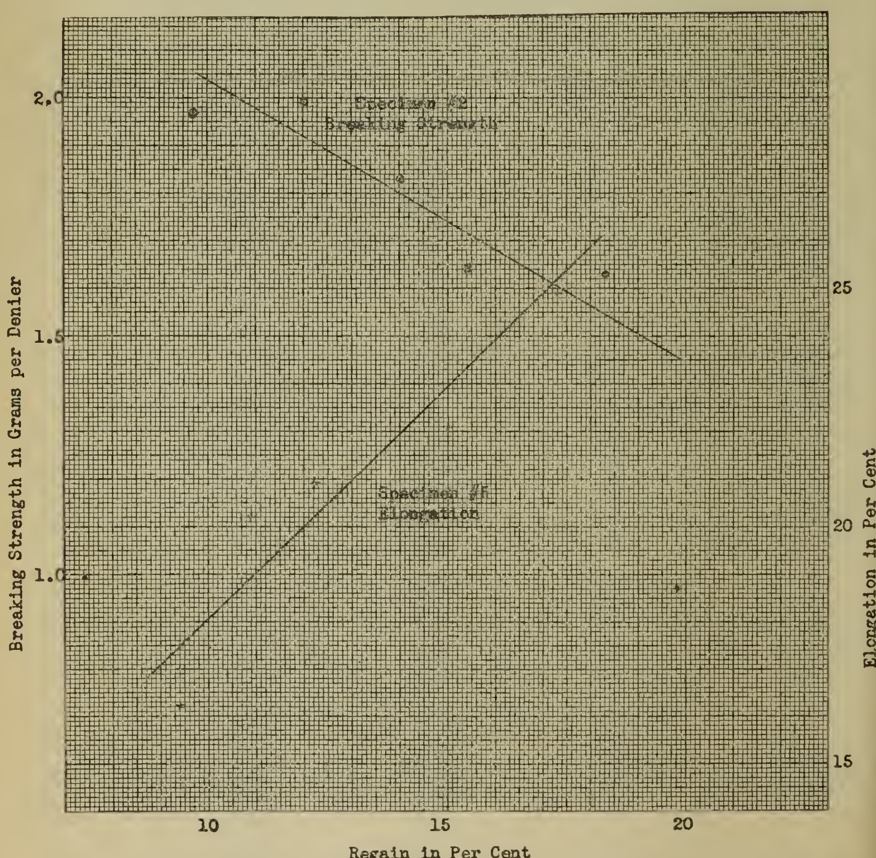
Description of Yarn Specimen	Relative Humidity (%)	Regain %	Breaking Strength (Grams)	Ultimate Elongation %
	75	18.7	201	22.5
#1	65	15.4	223	21.1
Denier 153.6	55	12.4	238	20.6
Filaments 42	45	10.7	255	18.9
Luster—Soft	35	10.4	257	15.7
	75	18.3	243	19.7
#2	65	15.4	244	18.4
Denier 148.5	55	14.0	272	15.7
Filaments 40	45	12.0	295	15.5
Luster—Soft Bright	35	9.7	292	14.1
	75	17.3	206	26.6
#3	65	16.1	217	23.7
Denier 154.6	55	14.9	237	21.0
Filaments 24	45	14.2	261	20.2
Luster—Bright	35	9.9	256	15.6
	75	18.8	155	16.7
#4	65	17.1	166	14.2
Denier 102.5	55	15.8	168	11.5
Filaments 40	45	14.0	189	12.7
	35	13.2	195	9.9
	75	17.3	208	24.9
#5	65	15.0	227	22.1
Denier 154.2	55	12.2	238	20.9
Filaments 40	45	10.9	256	20.2
	35	9.4	257	16.2
	75	15.0	244	16.8
#6	65	13.8	264	15.5
Denier 149.0	55	13.6	276	14.7
Filaments 40	45	13.3	285	13.2
Luster—Dull	35	11.5	275	11.8

TABLE II

AVERAGE EFFECT OF REGAIN UPON BREAKING STRENGTH AND ELONGATION OF VISCOSE RAYON YARN

Decrease in breaking strength per 1% increase in regain	.054 gram per denier
Decrease in breaking strength per 1% increase in relative humidity	.010 gram per denier
Increase in ultimate elongation per 1% increase in regain	1.0%
Increase in ultimate elongation per 1% increase in relative humidity	0.17%

FIGURE I.



Southwick Hall

SERIES 39, NO. 3. February, 1936

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

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1936

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Moody Street and Colonial Avenue

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6100. 2-'36. Order 6781.

CALENDAR

1935–1936

September 12–13, Thursday–Friday . . .	Entrance Examinations
September 16–21, Monday–Saturday . . .	Re-examinations
September 19, Thursday, 9.00 A.M.	Registration for Freshmen
September 23, Monday	Registration for upper-class students Classes begin for Freshmen
September 24, Tuesday	Classes begin for upper-class students
November 11, Monday	Armistice Day — Holiday
November 26, Tuesday, 4.45 P.M.	Thanksgiving recess begins
December 2, Monday, 9.00 A.M.	Thanksgiving recess ends
December 20, Friday, 4.45 P.M.	Christmas recess begins
January 6, Monday, 9.00 A.M.	Christmas recess ends
January 20, Monday	First term examinations begin
January 31, Friday	End of first term
February 3, Monday	Second term begins
April 3, Friday, 4.45 P.M.	Spring recess begins
April 13, Monday, 9.00 A.M.	Spring recess ends
April 20, Monday	Holiday — Observance of Patriots' Day
May 25, Monday	Second-term examinations begin
May 30, Saturday	Memorial Day — Holiday
June 9, Tuesday	Commencement
June 11–12, Thursday–Friday	Entrance Examinations

1936–1937

September 10–11, Thursday–Friday . . .	Entrance Examinations
September 14–19, Monday–Saturday . . .	Re-examinations
September 17, Thursday, 9.00 A.M.	Registration for Freshmen
September 21, Monday	Registration for upper-class students Classes begin for Freshmen
September 22, Tuesday	Classes begin for upper-class students
October 12, Monday	Columbus Day — Holiday
November 12, Thursday	Armistice Day — Holiday
November 24, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 30, Monday, 9.00 A.M.	Thanksgiving recess ends
December 18, Friday, 4.45 P.M.	Christmas recess begins
January 4, Monday, 9.00 A.M.	Christmas recess ends
January 18, Monday	First term examinations begin
January 29, Friday	End of first term
February 1, Monday	Second term begins
February 22, Monday	Washington's Birthday — Holiday
April 16, Friday, 4.45 P.M.	Spring recess begins
April 26, Monday, 9.00 A.M.	Spring recess ends
May 24, Monday	Second term examinations begin
May 31, Monday	Holiday — Observance of Memorial Day
June 8, Tuesday	Commencement
June 10–11, Thursday–Friday	Entrance Examinations

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Instructor in Chemistry

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Instructor in Mechanical Drawing

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Robert Frederick Jessen . . . . 298 Pawtucket Street
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Helen Gray Flack, S.B. . . . . 445 Stevens Street
Secretary

Mona Blanche Palmer . . . . 685 Westford Street
Clerk

Miriam Kaplan Hoffman, S.B. . . . . 64 Tyler Park
Clerk

HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern states. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because

of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had in charge the work of construction. The building completes the fourth side of the quadrangle, and in outward appearance corresponds to the architectural features of the other school buildings. It is a single-story building, and has the dimensions of 195 by 60 feet. Its interior is faced with cement brick made at the school during the progress of the work. These serve to give light-reflecting walls which are advantageous for the work of the Wool Manufacturing, Cotton Finishing and Chemistry and Dyeing

Departments that occupy this building. The funds for this building were provided by the State of Massachusetts.

The buildings are of modern mill construction adapted to educational uses and contain approximately 181,294 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus. Chest weights, wooden dumb-bells, Indian clubs, a set of traveling rings, a vaulting horse, parallel bars, a punching bag and several sets of foils and single sticks have been provided.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	11

Elective Subjects	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make ten points and present certificates showing satisfactory courses in such of the elective subjects to make three additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of twelve points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	9

Elective Subjects

Three may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 11, 1936; Thursday, September 10, 1936; Thursday, June 10, 1937:—
Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 12, 1936; Friday, September 11, 1936; Friday, June 11, 1937:—
Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students shall be the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential

subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 17, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—For all first-year students a minimum deposit of $25 is required to cover the cost of breakage, supplies, apparatus and chemicals used in the Chemical Laboratory, the unexpended balance to be returned to the student at the end of the year. For all students in second, third, and fourth years taking work in Chemistry and Dyeing Laboratories a deposit of $25 for the first term and $25 for the second term is required.

Students taking Machine Shop will be required to make deposit of $10 to cover cost of materials, supplies and breakage, the unexpended balance to be returned at the end of the year.

Students not taking Chemistry Laboratory or Machine Shop will be required to make a deposit of $10 each year to cover general breakage. The unexpended balance will be returned at the end of the year.

All deposits must be made before students can be admitted for laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop.)	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

SCHOLARSHIPS AND PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Color-

ing Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one, local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—A Student Section of the American Society of Mechanical Engineers holds meetings regularly in accordance with requirements of the national organization. The Student Section of the American Society of Dyers and Colorists holds meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. —A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1935–36

Harry W. Martin, '11, *President*
Harold W. Leitch, '12, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Ex-Officio Members of Executive Committee

Tracy A. Adams, '11
Charles W. Churchill, '06
Thomas T. Clark, '10
Stanley H. Wheelock, '05
Royal P. White, '04

Executive Committee

15 *Members*

Roy H. Bradford, '06
Alexander Campbell, '23
James F. Dewey, '04
Parker F. Dunlap, '34
Russell T. Fisher, '14
Olin D. Gay, '08
Thomas Joy, '26
Arnold J. Midwood, '05
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Henry S. Sawyer, '32
Dean W. Symmes, '22
J. Milton Washburn, '21
A. Edwin Wells, '20

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term

(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Mill Engineering B–34a	30	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135	Worsted Yarn Manufacture G–30	225

Third Year. Second Term

Knitting F–31	120	Worsted Yarn Manufacture G–30	225
Power Weaving D–32	105	Thesis.	
Woolen and Worsted Finishing H–30	75		

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–11a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Cotton Yarn Manufacture F–20a	90
Physics B–23a	45
Power Weaving D–24	90
Steam Engineering B–24	30
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	240

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20–21	90
Jacquard Design D–23	45
Physics B–23a	45
Power Weaving D–24	120
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	135

Third Year. First Term

Color and Dynamic Symmetry D–33	30
Cotton Finishing H–31	75
Cotton Yarn Manufacture F–30a	60
Power Weaving D–32	60
Textile Design and Cloth Construction D–30	105
Textile Testing G–31	30
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	90

Third Year. Second Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F–30a	60
Jacquard Design D–31	75
Power Weaving D–32	105
Textile Design and Cloth Construction D–30	75
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	60
Thesis.	

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultramicroscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several optional subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Advanced German E–21	45	Quantitative Analysis C–23	130
Adv. Organic Chemistry C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–23	15		

SECOND YEAR. SECOND TERM

Advanced German E–21	45	Stoichiometry C–24	15
Adv. Organic Chemistry C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

THIRD YEAR. FIRST TERM

Adv. Organic Chemistry Lect. C–34	15	Economics E–30	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
		Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

THIRD YEAR. SECOND TERM

Adv. Textile Chemistry and Dyeing Lab. C–32	90	Organic Laboratory C–36	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

FOURTH YEAR. FIRST TERM

Adv. Textile Chemistry and Dyeing Lab. C–44	75	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Options or Thesis C–52	90
Chemical Textile Testing C–43	45	Organic Laboratory C–41	75
Colloid Chemistry C–50	30	Quantitative Analysis C–46	15
Industrial Chemistry C–42	30	Report Writing C–47	15
		Technical German C-40	30
		Textile Marketing B–42	30

FOURTH YEAR. SECOND TERM

Advanced General Chemistry C–49	30	Organic Laboratory C–41	105
Adv. Textile Chemistry and Dyeing Lab. C–44	120	Rayon Manufacturing C–51	30
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Seminar in Business English E–40	15
Chemical Textile Testing C–43	45	Technical German C–40	30
Options or Thesis C–52	90	Technology of Wool Manufacture G–40	15
		Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The student is first thoroughly grounded in those fundamental principles of science upon which all industrial and engineering work rests. The foundation of his textile and technical training is in the subjects of mathematics, physics, chemistry, drawing, mechanics, mechanism, and technology of fibers, and their practical application.

Instruction is given in all the various branches of textile manufacturing through lectures, recitations and laboratory work. A large proportion of his time is spent in well-equipped textile departments where he studies and operates all of the machinery required in the conversion of cotton and wool fiber into yarns and fabrics. This includes cotton, wool and worsted yarn manufacturing, designing, weaving, knitting, dyeing and finishing. In his last year the course in textile testing acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering.

Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice.

Mill engineering familiarizes the student with mill design, construction, heating, lighting, humidification and fire protection. The arrangement of machinery and buildings for most efficient production and economical power distribution is also studied in detail.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

For the student who may desire the breadth of technical training which this course offers, but who wishes to specialize in either cotton or wool manufacturing, two options are offered. In these optional courses the student's entire textile time is devoted to the study of that particular fiber which he elects. Provision is also made for the substitution of knitting for weaving laboratory time in the case of those who prefer to lay more emphasis on knit fabrics.

During the past few years a demand has come from the distributing or marketing branches of the textile business for men with a four years' technical training. With the idea of offering courses which may better prepare graduates to meet this new call, the new Sales Option Course is offered.

There are also requests for a four-year Design Course which, while majoring in Textile Design, includes other subjects that help to make a broader course than the one of three years' duration. For this purpose the Design Option Course is offered. Like the other courses outlined, these will be subject to changes to meet new demands.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C–20	30
Machine Drawing B–21	75		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

THIRD YEAR. SECOND TERM

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	60
Mill Engineering B–45	67	Thesis	75

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	150	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	45
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	60
Mill Engineering B–45	30	Thesis	97

Fourth Year. Second Term

Business Administration B–46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Fiber Preparation G–20, 21	225	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–20	30
Machine Shop B–26	45		
Mathematics B–20	60		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B–21	45	Textile Chemistry and Dyeing Lect. C–20	30
Mathematics B–20	60		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

THIRD YEAR. SECOND TERM

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	68	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	127

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		

Third Year. Second Term

Color and Dynamic Symmetry D–33	45	Textile Design and Cloth Construction D–30	75
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B-41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D–41	90	Textile Testing B–43	60
Textile Marketing B–42	30	Thesis	60

Fourth Year. Second Term

Business Administration B–46	90	Jacquard Design and Weaving D-40	105
Color and Dynamic Symmetry D–33	45	Textile Design and Cloth Construction D–41	90
Cotton Finishing H–31	105	Thesis	90

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		
Principles of Marketing B–35	45		

Third Year. Second Term

Color and Dynamic Symmetry D–33	45	Statistics	45
Cotton Yarn Manufacture F–30a	60	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Marketing Methods B–36	60	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	30		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Principles of Selling and Advertising B–49	105	Textile Styling B–50	30
Selling Policies B–52	45	Textile Testing B–43	60
Textile Design and Cloth Construction D–41	60	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Jacquard Design and Weaving D–40	30
Color and Dynamic Symmetry D–33	45	Knitting F–31	75
Cotton Finishing H–31	105	Selling Policies B–52	45
Foreign Trade and Economic Geography B–51	45	Thesis	120

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration and applications of integration. In the second term the

topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B–20a. Preparation: B–10. This subject is a continuation of the work of the first year subject B–10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B–21. Preparation: B–10, B–12, B–14. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B–23. Preparation: B–10 and B–11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B–23a. Preparation: B–10 and B–11. This subject consists of the same topics as B–23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B–24. Preparation: B–12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B–25. Preparation: B–11, B–20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B–26. Preparation: B–11 and B–12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as possible to commercial machine-shop practice on textile machinery. The list of

tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B–30. Preparation: B–25. This is a continuation of Applied Mechanics B–25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B–31. Preparation: B–23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B–31a. Preparation: B–23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B–32. Preparation: B–12, B–20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B–33. Preparation: B–32. This course is a continuation of B–32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser tests; non-condensing and condensing engine and turbine tests;

heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

Principles of Marketing—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B-40. Preparation: B-10 and E-30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B-41. Preparation: B-23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and

marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B–43. Preparation: B–23, F–30 or G–30, D–32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B–44. Preparation: B–31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B–45. Preparation: B–34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B–46. Preparation: B–10 and E–30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B–47. Preparation: B–23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B-48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B-49. Preparation: B-36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B-50. Preparation: B-37, D-30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B-51. Preparation: E-30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B-52. Preparation: B-49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B-53. Preparation: B-20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C-10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C-11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–11. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–11a. Preparation: C–10, taken simultaneously. This course is similar to C–11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–12. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, B–12, B–14. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing

agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

THEORY OF DYEING.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

NATURAL ORGANIC COLORING MATTERS.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

MINERAL COLORING MATTERS.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

ARTIFICIAL COLORING MATTERS.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

MACHINERY USED IN DYEING.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C–20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C–22. Preparation: C–10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dye-

stuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C-23. Preparation: C-11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Smith's "Quantitative Chemical Analysis" is used as a text. [Course IV.]

Stoichiometry—C-24. Preparation: B-10, C-10, C-12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C-30. Preparation: C-23. The fundamental principles acquired in Course C-23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Griffin's "Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C-31. Preparation: C-22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's "Industrial Chemistry." Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-32. Preparation: C-20, C-21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Relative humidity, regain, counts and denier, twist, thickness, resilience, strength, porosity, staple, crimp, abrasion or wear.

Chemical Testing.—Qualitative tests, ash, ash alkalinity, oil and grease, soap, sizing and weighting, union analysis, baryta absorption, solubility in caustic, Methylene Blue absorption, copper number, viscosity in cuprammonia, acids and bases in textiles, damage to wool.

Optical Testing.—Spectroscope, spectrophotometer, colorimeter, tintometer, colorimetric pH apparatus, refractive index, use of ultraviolet. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-44. Preparation: C-32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C-45. Preparation: B-23, C-20, C-22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C-46. Preparation: C-30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C-47. Preparation: B-20a, E-20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C-48. Preparation: C-47. The object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-11, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to

introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C–50. Preparation: C–33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Absorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C–51. Preparation: C–32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Optional Subjects or Thesis during fourth year—C–52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take optional work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931–32 several options were introduced, each optional period being 45 hours per term and four of these being required during the year.

If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more option periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or optional subjects, will be required for graduation.

Options: Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both filters and fabrics. Students taking this option should have had Photography of the equivalent in experience.

ADVANCED MICROSCOPY. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

COLLOID CHEMISTRY LABORATORY. Experiments illustrating and amplifying the lecture course are performed. These may be on absorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

TEXTILE CHEMISTRY LABORATORY. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

MICROBIOLOGY I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

MICROBIOLOGY II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

RAYON. Advanced study of rayon dyeing.

PHYSICAL CHEMISTRY. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conductivity, etc.

ADVANCED PREPARATIVE CHEMISTRY. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D-10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D-20. For Cotton Goods—Preparation: D-10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D-21. For Woolen and Worsted Goods—Preparation: D-10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D-22. Preparation: D-10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D-23. Preparation: D-10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D-24. Preparation: D-10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D-30. Preparation: D-20 or D-21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves

and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Jacquard Design—D-31. This is a continuation of Jacquard Design D-23. [Course III.]

Power Weaving—D-32. Preparation: D-20, D-21, or D-23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Color and Dynamic Symmetry—D-33. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D-40. Preparation: D-23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D-41. Preparation D-10, D-20, D-21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course

who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E–20. Preparation: E–10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E–21. Preparation: E–11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E–30. Preparation: E–10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E–40. Preparation: E–10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT—F

Cotton Carding—F–20. Preparation: B–10, B–12, B–14. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in

considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

PICKING.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

CARDING.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

DRAWING.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

COMBING.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

ROVING.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

LABORATORY.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F–20a. Preparation: B–10, B–12, B–14. This course is similar to Course F–20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–25. Preparation: B–12, D–10. This course covers the same lectures and laboratory work as F–31. [Course VI, Option G.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

RING SPINNING AND TWISTING.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may

be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F-30a. Preparation: F-20a. This course is similar to Course F-30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-31. Preparation: B-12, D-10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F-31a. Preparation: B-12, D-10. This course embraces the same lectures as Course F-31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F-32. Preparation: F-20 or F-20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F-35. Preparation: F-25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F-34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.—Mixing and shading of colors and qualities of wool are studied and practiced. The details of burr pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning.—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W, D, S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the

various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G-31. Preparation: B-23, F-30 or G-30, D-24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G-40. Preparation: C-21, C-32, D-10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H-30. Preparation: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sew-

ing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders

of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time, and each year some new machine will be added by a manufacturer who finds it to his advantage to be represented here. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker. This machine is equipped with blade beaters in the first two sections and either a blade or a Kirschner beater in the third section. It has the new blending reserve, automatic rack release and the hunting cog knock-off.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. One frame is equipped with both common and metallic drawing rolls, electric stop motions and Ermine top roll clearers. The other frame and the railway head both are equipped with metallic rolls and mechanical stop motions. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough. The last named serves to illustrate the common English construction and how it differs from the American construction as illustrated in the other roving machines.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. Four of these frames are equipped with individual motor drives,—one chain drive, one Texrope drive, one gear drive and one Washburn clutch drive. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames, and has an individual alternating current motor connected through a Reeves automatically controlled variable speed drive. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. This machine is equipped with an individual alternating current motor with a chain drive. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity, This equipment is suitable to spin coarse numbers from cotton wastes to be used in such materials as coarse sheeting, osnaburgs, twine and mop yarns.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired percent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. In addition, there is a gas conditioning oven to use in determining moisture content and regain. A number of scales and balances, together with yarn reels, roving reels and measuring boards make up the equipment for routine mill sizing tests.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flatlock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division.—The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company of North Andover, Mass.: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher,

each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company; one mule headstock mounted on trucks for instruction purposes; one fancy yarn twister with chain and gear equipment; one filet winding drum stand with tension bars, wind, etc., for applying card clothing.

Installed by C. G. Sargent's Sons Corporation, Graniteville, Mass.: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc., of Worcester, Mass.: One 120-spindle cam mule complete; one mule headstock mounted on trucks for instruction purposes.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son, Worcester, Mass.: One card grinding stand with two traverse grinders complete.

Equipment: Modern ferrule type fiber head jack spools and bobbins by U. S. Bobbin and Shuttle Company of Lawrence; yarn baskets by Steele Supply Company, Cambridge, Mass.; hand cards by Howard Brothers of Worcester and Davis & Furber Machine Company; ring travellers by Victor Company; static suppressors by Chapman Neutralizer Company.

Shoddy or Reworked Fiber Division.—Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division.—Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., Leeds, England, equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops of Biddeford, Me.; two worsted combs with baller punch, one made by Crompton & Knowles, Worcester, and the second made by James Smith & Sons, of Worcester, Mass.; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stell, Keighley, England.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, Keighley, England, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap spinner, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer spinner, one 12-spindle ring spinner, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. In addition to this the Saco-Lowell Shops, Biddeford, Me., have in-

stalled the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system through its automatic control. In this laboratory are installed six humidifiers and four Comin's High Duty heads, which are supplied from an electric-driven triplex power pump located in the power house. This same pumping equipment supplies the American Moistening Company's humidifiers operating in the Cotton Yarn Department.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning, the machinery has been made by the Société Alsacienne de Constructions Mechaniques, Mulhouse, France, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads), gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company, Fitchburg, Mass. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

Textile Testing Division.—Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company of Boston; single yarn and fabric strength-testing machines made by G. R. Smith & Company, Bradford, England; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper, Leipzig, Germany. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company of Providence, R. I., a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, also an abrasion machine for testing resistance to wear of twines, tapes, and all stripped flat fabrics, one General Electric mercury vapor lamp with stand for top inspection. For the automatic control of temperature and humidity there has been installed by the American Moistening Company, of Boston, one of its automatic humidity and temperature regulators.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company of New York.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company of Lowell. The Whitin Machine Company, Whitinsville, Mass., has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, Worcester, Mass., a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8-spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser,

one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company of North Andover, Mass.

The Weaving Department contains four looms supplied by the Draper Corporation of Hopedale, Mass., which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company of Readville, Mass., has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, Whitinsville, Mass., a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company, Lisbon Falls, Maine. The Hopedale Manufacturing Company of Milford, Mass., has recently installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 16-harness lappet loom, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company, Clinton, Mass. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons, Paterson, N. J.; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table, with ample facilities to provide distilled water through the use of a Barnstead Water Still. The Balance Room, which is adjacent to the laboratory, has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus,

Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé refractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with individual benches, small dyeing apparatus, reels, balances, apparatus for dye testing, such as frames for exposing dyed material to light, and a complete collection of dyestuff samples and sample cards. There are also fifty-six steam coil experimental dyeing baths, a drying chamber and ageing chamber, in addition to a Hurricane Dryer, Class D, made by the Philadelphia Drying Machinery Company, Pennsylvania. Adjacent to the Experimental Dyeing Laboratory there has been provided a well-lighted room for the storage of a great variety of dyestuffs. Steel shelving has been arranged so that the samples are easy of access. All samples are catalogued in a card file, thus facilitating their use.

The Industrial Chemistry Laboratory contains the following: one filter press, type E. T. Shriver & Company; a single-acting triplex plunger pump, Goulds Manufacturing Company; a vacuum drying apparatus, a surface condenser, a Packard vacuum pump, Norman Hubbard's Sons; a vacuum evaporator, Swenson system, American Foundry and Machine Company; a centrifugal, C. H. Chavant & Company; a double jar mill, F. I. Stokes & Company.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, Worcester, Mass., a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter, the Permutit Company, New York City; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine, the Textile-Finishing Machine Company, Providence, R. I.; a set of drying cans by the same concern; a chain dyeing machine, T. C. Entwistle Company, Lowell, Mass.; a raw stock drying table, Proctor & Schwartz, Philadelphia, Pa.; a padding mangle, Arlington Machine Works, Arlington, Mass.; a hydro-extractor, W. H. Tolhurst & Son, Troy, N. Y.; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. The Franklin Process Company, Providence, R. I., has furnished a 25-pound bronze dyeing machine. Of the various dye

tubs, one is equipped with a Monel metal lining to withstand the action of various chemicals and dyes.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company, Orange, Mass.; a sample fulling mill, a kicker mill, furnished by James Hunter & Company, North Adams, Mass.; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company of Worcester has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air-cooling machine, equipped with a direct connected motor and a Nash pump; a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A.W.C. measuring and weighing machine, furnished by Parks & Woolson, Springfield, Vt.; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co., Woonsocket, R. I.; a tentering and drying machine furnished by John Heathcote, Providence, R. I.; a single crabbing machine, H. W. Butterworth & Son, Philadelphia, Pa.; a 72-inch woolen napper donated by Davis & Furber, North Andover, Mass.; a 32-inch basket hydro-extractor, W. H. Tolhurst, Troy, N. Y.; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company, New York; a steam press for underwear, United States Hoffman Company, Syracuse, N. Y.; a sewing machine, Birch Brothers, Somerville, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company, Worcester, Mass.; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company, Salem, Mass.; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers, Somerville, Mass.; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber, North Andover, Mass. (the ball bearings were donated by the Fafnir Bearing Company, New Britain, Conn.); an 8-inch belt lacer furnished by the Clipper Belt Lacer Company of Grand Rapids, Mich.; a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company, Boston; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system, Files Engineering Company, Inc., Bridgeport, Conn.; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company, Providence, R. I.; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company, Providence, R. I.; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company, Boston, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company, Philadelphia, Pa. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company, Boston, Mass.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alder absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6

Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments. For the measurement of flow of air there are a steam-driven Sturtevant fan and a motor-driven Massachusetts fan with heater combined for heating and drying experiments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-Kilowatt rotary transformer and three Westinghouse stationary transformers. The other section of the laboratory is known as the instrument laboratory and is for the purpose of giving instruction in the measurement of current voltage, resistance, and in the calibration of instruments. It contains a 5-kilowatt Crocker-Wheeler balancer, a 160-ampere hour storage battery, a 5-kilowatt 220-volt to 440-volt General Electric transformer, a Westinghouse portable wattmeter with current and potential transformers, three wattmeters, two ammeters and a voltmeter, all of the General Electric portable alternating current type, a 30-volt alternating current Roller Smith voltmeter, a 5 to 10-scale Weston ammeter (electro-dynamometer type), a Weston millivoltmeter with 2, 20, 50 and 200 ampere shunts, three 250-volt direct current Weston voltmeters, a 150-ampere, two model 45, two model 260, Weston portable ammeters, a Weston model 260 voltmeter, a Thompson 50-ampere recording wattmeter, a General Electric rotating standard wattmeter, two General Electric induction type watt hour meters, an Esterline portable curve drawing wattmeter, a 100-ampere Leeds & Northrup Standard Resistance, a Leeds & Northrup Ayrton shunt, a Weston laboratory standard voltmeter with 600-volt multiplier, a Leeds & Northrup potentiometer, a D'Arsonval wall type galvanometer, a Wheatstone bridge with galvanometer, a slide wire bridge and electro-dynamometer, Weston Standard cell, potential phase shifter, a standard Leeds & Northrup photometer with Lummer-Brodhun screen, and Macbeth illuminometer made by the same concern.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10-foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company, Nashua, N. H.; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company, Worcester, Mass.; an engine lathe, 18-inch swing, 6-foot bed from Champion Tool Works, Cincinnati, Ohio; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons, Fitchburg, Mass.; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company, Milwaukee, Wis.; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company, Nashua, N. H.; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son, Worcester, Mass.; one 14-inch single sensitive drill, from the Stanley Manufacturing Company, Lawrence, Mass.; one No. 1 Universal grinder, from Landis Tool Company, Waynesboro, Pa.; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount, Everett, Mass.; an American twist drill grinder, from the Heald Machine Company, Worcester, Mass.; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company, Cincinnati, Ohio; one 30-inch grindstone and frame, from the Athol Machine Company, Athol, Mass.; a single spindle centering machine, from D. E. Whiton Machine Company, New London, Conn.; one 15-inch shaper, from Potter & Johnson, Pawtucket, R. I.; one power hacksaw, from the Fairbanks Company, Boston, Mass.; one cold saw, from John T. Burr & Son, Brooklyn, N. Y.; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 4, 1935

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Textile Chemistry and Dyeing, no thesis subjects have been listed.

Albert Stephen Alcott, Jr.	Lowell, Mass.
John Silas Beattie	Lowell, Mass.
William John Curtin	Lowell, Mass.
Ernest Lorenzo Dion	Lawrence, Mass.
Edmund Eismann	Pawtucket, R. I.
Zoltan Roland Farkas	New York City
Hyman Herbert Greenbaum	Haverhill, Mass.
Vernon Harcourt Griffin	Swampscott, Mass.
Ralph Harwood	New York City
John Vincent Heffernan	North Smithfield, R. I.
Chester M. Kopatch	Lawrence, Mass.
Kenneth Everett Leslie	Haverhill, Mass.
Swamirao Ramrao Lokur	Ahmedabad, India
James Humphrey Parechanian	Lowell, Mass.
Leonard John Phelan	Ipswich, Mass.
Max David Plovnick	Roxbury, Mass.
Leo Louis Poremba	Lowell, Mass.
Herman Walter Schoelzel, Jr.	Methuen, Mass.
Joseph Shain	Roxbury, Mass.
Howard Nathaniel Stolzberg	Haverhill, Mass.
George Robert Thompson	Lowell, Mass.

Bachelor of Textile Engineering

John Francis Bogdan, Nashua, N. H. "A Comparison of No. 6 Cotton Yarns Made with Different Percentages of Card Strippings." Thesis with Luis Echavarria.

Edward Hosmer Bradford, Andover, Mass. "A Comparative Study of Strip, Grab, and Directed Bursting Strength Tests of Woven Fabrics."

Daniel Francis Connolly, Jr., Salem, Mass. "A Study of the Walen Evenness Tester to Determine Its Possibilities in Determining the Free Diameter of Yarn and Its Evenness."

Luis Echavarria, Medellin, Colombia, S. A. Thesis with John F. Bogdan.

Evan Hobbs Fairbanks, Wakefield, Mass. "A Study of the Relation Between the Plating of Knitting Yarns and the Twist in the Plated Yarn."

Robert William Lauder, Haverhill, Mass. "An Investigation of the Possibility of Using the Verigraph to Determine the Regain of Fabrics."

William Joseph Stein, New Haven, Conn. "The Construction of a Designer's Blanket for a Cotton Shirting."

Diploma in Wool Manufacture

Bradford Lewis Boynton, Andover, Mass. "Construction of a Men's Wear Worsted."

William Edwin Shann, Putnam, Conn. "Reproduction of a Fancy Worsted Suiting."

Prizes awarded in June, 1935

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *John Francis Bogdan.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Kenneth Everett Leslie.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Hugh F. Carroll.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *Gustave W. Hakanson.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Herman T. Buckley.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *W. Hersey Howard.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Alcott, Albert Stephen, Jr., IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1935	59 Canton Street
Manderbach, Harold Mills, VI, Ann Arbor, Mich. B.A., University of Michigan, 1924, Captain U.S.A.	28 Daniels Street
Calder, Marian Brownson, VI, Dallas, Texas B.S., College of Industrial Arts, Texas State College for Women, 1930	137 Riverside Street
Parechanian, James Humphrey, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1935	1 Summer Court
Ryberg, Bertil August, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1929	56 Harvard Street

Under Graduate Students

Candidates for Degree

Class of 1936

Anthony, Henry Steere, IV, Lowell, Mass.	20 Loring Street
Basdikis, Charles Apostolos, IV, Lowell, Mass.	8 LaGrange Street
Bates, Wesley Elliot, VI, East Milton, Mass.	———
Boyd, William, Jr., IV, Toledo, Ohio	52 Standish Street
Cobb, Joseph Calvin, VI, Dorchester, Mass.	———
Crawford, Robert Thomas, VI, Boston, Mass.	———
deGruchy, James Campbell, Jr., IV, Stoneham. Mass.	———
Fuller, Roland Monroe, VI, Lowell, Mass.	R. F. D. No. 1
Gagnon, Roland Octave, IV, Lowell, Mass.	279 Liberty Street
Georgacoulis, George, IV, Lowell, Mass.	336 Suffolk Street
Hadley, George Clarence, Jr., B.S. in A.E., VI, North Adams, Mass.	Omicron Pi House
Hodgman, Richard Albert, VI, Stoneham, Mass.	Omicron Pi House
Holden, Arthur Newton, VI, No. Billerica, Mass.	———
Holgate, Benjamin Alexander, VI, Lowell, Mass.	97 Grove Street
Ireland, Wilson Gerard, VI, Melrose, Mass.	137 Riverside Street
Johnston, Lee Gale, IV, Haverhill, Mass.	———
Kaiser, Raymond John, VI, Bloomfield, N. J.	Omicron Pi House
Landau, David, IV, Brooklyn, N. Y.	142 Riverside Street
Lee, Shao-fong, VI, Shanghai, China	53 Mt. Hope Street
Lincoln, Charles Ernest, IV, Mattapan, Mass.	43 Plymouth Street
McQuade, Allan John, VI, Lowell, Mass.	600 Andover Street
Markarian, Moushy, IV, Lowell, Mass.	103 Lawrence Street
Moreno, Emilio Gomez, Jr., VI, Graniteville, Mass.	———
Olshinski, Matthew John, VI, Chelmsford, Mass.	———
Redmond, James Reynolds, IV, Lowell, Mass.	84 Bartlett Street
Roarke, John James, IV, Lowell, Mass.	75 Viola Street
Shah, Kantilal Hiralal, VI, Bombay, India	53 Mt. Hope Street
Smith, William Arthur, Jr., VI, Lowell, Mass.	548 Fletcher Street
Storey, Edwin Gerald, VI, Chatham, N. J.	43 Plymouth Street
Tyler, Bernard James, IV, Lowell, Mass.	30 Epping Street
Valentine, Preston Sumner, IV, Cochituate, Mass.	53 Mt. Hope Street
Welch, William Paul, Jr., IV, Lowell, Mass.	76 South Highland Street
Wormwood, Herbert Alvin, IV, Andover, Mass.	———

Class of 1937

Bassett, Louis Loss, VI, Lowell, Mass.	825 Merrimack Street
Boordetsky, Sidney Morris, VI, Cambridge, Mass.	825 Merrimack Street
Carroll, Hugh Francis, IV, Medford, Mass.	———

Home Address	*Lowell Address*
Churchill, Harry Coburn, IV, Lowell, Mass.	214 Third Street
Daly, William James, VI, Andover, Mass.	———
Dunn, Austin Pember, VI, Shirley, Mass.	———
Fisher, Thomas Nathan, VI, Lowell, Mass.	100 Sanders Avenue
Hakanson, Gustave Warren, IV, Winchester, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kennedy, Robert Miller, VI, Dunstable, Mass.	———
LeBel, Claude Merwin, VI, New York, N. Y.	32 Mill Street, Collinsville
Lemkin, Uriel William, VI, Lowell, Mass.	24 D Street
Luescher, Frank Oscar, IV, Pawtucket, R. I.	548 Fletcher Street
Lyle, Robert Keith, IV, Lowell, Mass.	86 Orleans Street
Megas, Charles, IV, Lowell, Mass.	114 Rock Street
Natsios, Basil Andrew, IV, Lowell, Mass.	98 Lewis Street
Nerney, Francis Xavier, IV, Lowell, Mass.	46 Dana Street
Olcott, Harry Depew, IV, Lowell, Mass.	56 Montview Avenue
Reed, Harold Ernest, VI, Nashua, N. H.	———
Regan, Paul William, IV, Lowell, Mass.	16 Linden Street
Robbins, Lucy Wiley, VI, Lowell, Mass.	102 South Loring Street
Spanos, James Peter, IV, Lowell, Mass.	14 West Bowers Street
Sung, Harvey Chih, VI, Tientsin, China	43 Plymouth Street
Vaniotis, Socrates Vasilios, IV, Lowell, Mass.	13 Willie Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlboro Street
Wilkinson, Herbert William, Jr., IV, Edgewood, R. I.	Omicron Pi House
Wright, George Ward, Jr., IV, Newtonville, Mass.	Omicron Pi House

Class of 1938

Allard, Frederick Pratt, IV, Lowell, Mass.	104 Eleventh Street
Broadhurst, Russell Denton, IV, Middletown, Conn.	50 Standish Street
Buckley, Herman Timothy, IV, East Chelmsford, Mass.	———
Cherr, Alda Jay, IV, New York, N. Y.	32 Mt. Washington Street
Clarke, John Thomas, VI, Chelmsford, Mass.	———
Comstock, Tom, VI, Great Barrington, Mass.	548 Fletcher Street
Copp, Sewall Edward, VI, Brockton, Mass.	49 Salem Street, Haverhill
Cutrumbes, Demosthenes John, IV, Dracut, Mass.	———
Depoian, Varken John, IV, Lowell, Mass.	8 Gates Street
Dori, Anita Marie, VI, Chester, Mass.	103 South Loring Street
Dupee, George Richardson, VI, Lowell, Mass.	213 Branch Street
Fine, Milton Arnold, VI, Brighton, Mass.	825 Merrimack Street
Fleming, John Harvey, VI, Sanford, Me.	156 Methuen Street
Fox, Kenneth Russell, VI, Lowell, Mass.	359 Beacon Street
Freedman, David, VI, Boston, Mass.	825 Merrimack Street
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Garcia, Lorenzo Montero, VI, Mexico D. F., Mexico	9 White Street
Getchell, Nelson Fletcher, IV, Lowell, Mass.	75 Pine Street
Grossman, Clinton, IV, Providence, R. I.	142 Riverside Street
Hardy, Thomas Wadsworth, IV, Lowell, Mass.	30 Chauncey Avenue
Harpoot, Burgess Charles, VI, Lowell, Mass.	185 Liberty Street
HoLem, Charlie, VI, Calgary, Alberta	43 Plymouth Street
Howard, Winfield Hersey, IV, North Chelmsford, Mass.	———
Kaplan, Samuel Gilbert, IV, Lowell, Mass.	472 Wilder Street
Kelakos, Charles George, VI, Lowell, Mass.	47 Lagrange Street
Kelly, Warren Thomas, VI, Lowell, Mass.	41 E Street
Klosowicz, Edward Joseph, VI, Lowell, Mass.	40 Read Street
Knight, Richard Greene Howland, Jr., VI, Fall River, Mass.	43 Plymouth Street

Home Address	*Lowell Address*
Lemieux, Robert Alphonse, IV, Lowell, Mass.	56 Third Avenue
Littlefield, Carl Richard, VI, Lowell, Mass.	69 Warwick Street
Lutz, Helmuth Erich, IV, Lowell, Mass.	7 Houghton Street
Lyons, James Francis, Jr., IV, Nashua, N. H.	———
McMahon, Martin Edward, IV, Lowell, Mass.	43 London Street
Mahoney, Joseph Healey, IV, Andover, Mass.	———
Oliver, Roger Barton, VI, Lowell, Mass.	62 Glenwood Street
Olsen, Earl Edward, VI, Reading, Mass.	———
Page, Herbert Stanton, IV, Chelmsford, Mass.	———
Paige, Walter Hale, Jr., New Bedford, Mass.	Omicron Pi House
Ploubides, John Peter, IV, Lowell, Mass.	59 Varney Street
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Ritchie, Newell Baird, IV, Concord, N. H.	———
Rosenstein, Leo David, VI, Baltimore, Md.	43 Plymouth Street
Shapiro, Sidney, VI, Lowell, Mass.	29 Daly Street
Sheehan, Leo James, IV, Lowell, Mass.	R. F. D. No. 1
Sood, George David, IV, Woonsocket, R. I.	793 Merrimack Street
Stanley, Donald Edward, IV, Lowell, Mass.	706 Stevens Street
Thomas, Fred, VI, Holden, Mass.	65 Sterling Street

Class of 1939

Allaire, Alexander Hector, IV, Woonsocket, R. I.	793 Merrimack Street
Archinski, Anthony, IV, Lowell, Mass.	48 Meade Street
Baker, Jeanne Phyllis, VI, Concord, Mass.	Dalton Road, Chelmsford
Banta, John Garrett, VI, Grantwood, N. J.	53 Mt. Hope Street
Beauregard, Albert Joseph, VI, Lowell, Mass.	258 Varnum Avenue
Bone, Arthur Peter Stuart, VI, Hollywood, Calif.	548 Fletcher Street
Caveney, William John, IV, Lowell, Mass.	122 South Walker Street
Colby, Vernon Warren, IV, Haverhill, Mass.	———
Comins, Richard Coolidge, VI, Ballardvale, Mass.	———
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Dick, Henry Kendal, VI, Bloomfield, N. J.	65 Sterling Street
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Greene, John Lester, VI, Lowell, Mass.	388 East Merrimack Street
Grinnell, King Asa, VI, Fall River, Mass.	63 Varnum Avenue
Hatch, Robert Clinton, VI, Shirley, Mass.	Omicron Pi House
Jarek, Helen Jane, IV, Lowell, Mass.	74 Eleventh Street
Kareores, Gregory George, VI, Lowell, Mass.	52 Lewis Street
Kiernan, James Vincent, VI, Dracut, Mass.	———
LaBonte, Andrew Shea, VI, Lawrence, Mass.	———
Lambert, Robert DeForest, VI, Tyngsboro, Mass.	———
Levin, Samuel, IV, Lowell, Mass.	43 Ware Street
Marsden, Sidney Robert, IV, Methuen, Mass.	———
Mason, Maurice Patrick, IV, Lowell, Mass.	22 Greendale Avenue
Miller, Arnold Irving, IV, Lowell, Mass.	268 Shaw Street
Monahan, Harold Joseph, IV, Dorchester, Mass.	———
Olsen, Herbert Charles, IV, Reading, Mass.	———
Patsourakos, James Peter, IV, Lowell, Mass.	619 Market Street
Prescott, William Benjamin, IV, Westford, Mass.	———
Preston, Adrian Burnham, IV, Center Barnstead, N. H.	140 Methuen Street
Read, Clinton Jay, VI, Cranston, R. I.	63 Varnum Avenue
Reed, Everett Carlton, VI, Lowell, Mass.	385 Parker Street
Reed, William Thorncroft, VI, Lowell, Mass.	30 Frothingham Street
Rowntree, Clyde Burton, IV, Lowell, Mass.	134 Liberty Street
Shuster, Nathan George, IV, Lowell, Mass.	47 Washington Street
Spevack, Edward, IV, Carlstadt, N. J.	43 Plymouth Street
Steinberg, Sidney, VI, Brooklyn, N. Y.	17 Edson Street

Home Address	*Lowell Address*
Storey, Victor Wilson, IV, Dracut, Mass.	———
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Tuttle, Kendall Chapin, IV, Groton, Mass.	———
Winkler, Burton Cole, IV, Elizabeth, N. J.	548 Fletcher Street

Diploma Students

Class of 1936

Dursin, Louis Jules, II, Woonsocket, R. I.	548 Fletcher Street
Gould, Charles Edwin, II, Portland, Me.	Omicron Pi House
Jessen, Robert Frederick, I, Whitinsville, Mass.	137 Riverside Street
Wilson, Raymond Bachmann, II, Pawtucket, R. I.	146 Parkview Avenue

Class of 1937

Gay, Leon Stearns, Jr., II, Cavendish, Vt.,	515 Varnum Avenue, rear
Pease, Kilburn Gray, I, Greenville, N. H.	156 Methuen Street

Class of 1938

Brantman, Jackson Agmor, II, Brooklyn, N. Y.	137 Riverside Street
Ekstrand, Frederic Lawrence, II, Stafford Springs, Conn.	20 Summit Ave., Lawrence
Gianaris, George Demetrios, III, Lowell, Mass.	678 Lakeview Avenue
Hackett, John James, III, Groton, Mass.	———
Kane, Roger Hugh, II, Cherry Valley, Mass.	75 Fourth Avenue
Lehto, Reino Gust, III, Maynard, Mass.	———
O'Donoghue, Eileen Margaret, III, Lowell, Mass.	20 Columbia Street

Special Students

Archambeault, Alvine, III, Lowell, Mass.	81 Price Street
Athanasopoulos, Louis Peter, III, Lowell, Mass.	108 Adams Street
Basabis, Thomas, III, Methuen, Mass.	———
Bogacz, John, III, Lowell, Mass.	10 Morey Place
Bolton, John Blakely, III, Methuen, Mass.	———
Brockunier, Clare Reed, III, Lowell, Mass.	84 Fairmount Street
Doukszewicz, Joseph Francis, III, Lowell, Mass.	52 Whipple Street
Frank, Joseph, III, Lawrence, Mass.	———
Granatstein, Joseph Morrell, II, Toronto, Ont.	9 White Street
Hofmann, Paul Louis, III, Lawrence, Mass.	———
Klebanoff, Sydney, I, Toronto, Ont.	137 Riverside Street
Levine, Saul, VI, Hartford, Conn.	137 Riverside Street
Lillis, Marvin Hale, IV, Lawrence, Mass.	Y. M. C. A.
Lyman, Edwin Jesse, I, Brookline, Mass.	156 Methuen Street
Mann, Billings Leland, III, Fall River, Mass.	515 Varnum Avenue
Monahan, Richard Lee, VI, West Chelmsford, Mass.	———
Raymond, Gardner Lawrence, III, Bedford, Mass.	548 Fletcher Street
Reed, Grace Corbett, III, Reading, Mass.	———
Reidy, Joseph Edward, IV, Lowell, Mass.	188 Chelmsford Street
St. Dennis, Leo Joseph, I, Nashua, N. H.	———
Salpas, Cosmos George, I, Lowell, Mass.	232 Adams Street
Scharschmidt, Eugene Herman, III, Providence, R. I.	548 Fletcher Street
Stokes, Alfred Roscoe, II, Rumford, R. I.	548 Fletcher Street
Suzedelys, Stanley, III, Methuen, Mass.	———
Westkage, Felix Joseph, III, Dracut, Mass.	———
Weymouth, Charles William, I, Hudson, N. H.	———

ALPHABETICAL LIST OF GRADUATES

The following list has been corrected in accordance with information received previous to February 1, 1936. Any information regarding incorrect or missing addresses is earnestly solicited.

B.T.C. indicates the degree of Bachelor of Textile Chemistry; B.T.D. indicates the degree of Bachelor of Textile Dyeing; B.T.E. indicates the degree of Bachelor of Textile Engineering; D indicates a diploma; C indicates a certificate (covering a partial course only). Degrees were issued beginning with the year 1913.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.

Abbott, George Richard, II, '08 (D). Andover, Mass.

Adams, Floyd Willington, VI, '16 (B.T.E.).

Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.

Adams, Tracy Addison, IV, '11 (D). Vice-President, Arnold Print Works, North Adams, Mass.

Albrecht, Charles Henry, IV, '17 (B.T.C.). Chemist, Atlantic Mills, Providence, R. I.

Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.). Graduate Student, Lowell Textile Institute, Lowell, Mass.

Allard, Edward Joseph, IV, '31 (B.T.C.). Chemist, National Aniline & Chemical Company, Boston, Mass.

Allen, Grover Stanley, IV, '34 (B.T.C.). Chemist, The Gardiner Hall, Jr., Company, South Willington, Conn.

Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.

Anderson, Arthur Illman, IV, '24 (B.T.C.). Associate, Department of Research, Laundryowners National Association, Joliet, Ill.

Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.

Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.

Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Lowell, Mass.

Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.

Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.

Arundale, Henry Barnes, II, '07 (D). Textile Technician, for G. H. Heath & Co., Ltd., Macclesfield, England, Andover, Mass.

Atwood, Henry Jones, II, '23 (D). Assistant Superintendent, Daniels Manufacturing Company, East Brookfield, Mass.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.

Babigan, Edward, IV, '33 (B.T.C.). 121 Bellevue Street, Lowell, Mass.

Babigan, Raymond, IV, '24 (B.T.C.). Associate Examiner, United States Patent Office, Washington, D. C.

Bachelder, Charles Edward, IV, '24 (B.T.C.) Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.

Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study, Worsted Division, Pacific Mills, Lawrence, Mass.

Bailey, Joseph W., I, '99 (D). Agent, Booth Manufacturing Company, New Bedford, Mass.

Bailey, Lester Harold, IV, '24 (B.T.C.). Chemist, United States Finishing Company, Pawtucket, R. I.

Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.

Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.

Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.

Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). Vice-President and Secretary, Walter Blue & Co., Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B. T. C.). President, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin, I, '00 (D). Second Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beattie, John Silas, IV, '35 (B.T.C.). Chemist, Massachusetts Mohair Plush Company, Lowell, Mass.

Beck, Frederic Christian, II, '24 (D). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). With Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). With Calgon, Inc., Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler and Designer, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Overseer of Dry Finishing, Glenark Mill, Woonsocket, R. I.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). 30 West Street, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Chemist, Armour & Co., North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Electrolux, Inc., Maywood, N. J.

Blake, Parker Gould, VI, '14 (D). Sales Manager, Slingsby Silks, Ltd., Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). Assistant Selling Agent, Ludlow Manufacturing and Sales Company, 211 Congress Street, Boston, Mass.

Bogdan, John Francis, VI, '35 (B.T.E.). Second Hand, Cotton Winding Department, Manville Jenckes Corporation, Manville, R. I.

Booth, James Mooney, IV, '24 (B.T.C.). Salesman, The Huron Milling Company, Inc., 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Designer, Amoskeag Manufacturing Company, Manchester, N. H.

Boynton, Bradford Lewis, II, '35 (D). 17 Hidden Road, Andover, Mass.
Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.
Bradford, Edward Hosmer, VI, '35 (B.T.E.). Lawrence Manufacturing Company, Lowell, Mass.
Bradford, Harold Palmer, II, '25 (D). 90 Beach Street, Malden, Mass.
Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.
Bradford, William Swanton, VI, '31 (B.T.E.). Assistant Superintendent, Dress Goods Division, Lawrence Manufacturing Company, Lowell, Mass.
Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.
Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.
Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.
Brainerd, Carl Emil, IV, '20 (B.T.C.). Superintendent of Dyeing, F. C. Huyck & Sons, Albany, N. Y.
Brandt, Carl Dewey, VI, '20 (B.T.E.). In charge Cotton Spinning Research, Whitin Machine Works, Whitinsville, Mass.
Brannen, Leon Vincent, III, '07 (C).
Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.
Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.
Bridges, Herbert Gardner, II, '34 (D). Assistant to Superintendent, Sanford Mills, Sanford, Me.
Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears & Co., 65 Worth Street, New York City.
Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.
Brosnan, William Francis, IV, '27 (B.T.C.). Superintendent of Dyeing, Bradford Dyeing Association, Bradford, R. I.
Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.
Brown, Philip Franklin, II, '23 (D). Assistant Director of Sales, DuPont Rayon Company, 350 Fifth Avenue, New York City.
Brown, Rollins Goldthwaite, IV, '12 (D).
Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.
Brown, Will George, Jr., IV, '22 (B.T.C.). Chemist, American Hide & Leather Company, Lowell, Mass.
Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.
Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.
Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.
Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.
Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.
Burke, James Edward, Jr., IV, '34 (B.T.C.). 77 Durant Street, Lowell, Mass.
Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.
Burns, Robert, IV, '28 (B.T.C.).
Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.
Buzzell, Harry Saville, VI, '29 (B.T.E.). Color Technician, Oxford Paper Company, Rumford, Maine.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.

Campbell, Alexander, VI, '23 (B.T.E.). Assistant Chief Engineer, Quincy Market Cold Storage & Warehouse Company, Boston, Mass.

Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.

Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.

Campbell, Orison Sargent, II, '03 (D). Manager, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B.T.C.). Textile Chemist, Sandoz Chemical Works, 36 Purchase Street, Boston, Mass.

Carleton, Joseph Raddin, III, '30 (D). Assistant Designer, The Bridgeport Coach Lace Company, Bridgeport, Conn.

Carr, George Everett, I, '05 (D). Industrial Engineer, C. F. Mueller Company, 180 Baldwin Avenue, Jersey City, N. J.

Carr, Paul Edward, II, '24 (D). Designer, Cascade Woolen Mills, Oakland, Me.

Carter, Robert Albion, IV, '02 (D). District Manager, DuPont Dyestuffs, E. I. du Pont de Nemours & Co., Birdsboro, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). Dyer, Hodges Finishing Company, East Dedham, Mass.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). Manager, Barbour Mills, Montello, Mass.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.).

Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.

Church, Charles Royal, II, '06 (C). Teacher and Athletic Coach, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clark, Earl William, IV, '18 (B.T.C.). Salem Depot, N. H.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). Dyer, Seamans & Cobb Thread Mills, Hopkinton, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mill, Lowell, Mass.

Cleary, Charles Joseph, II, '13 (D). Textile Technologist, United States Army Air Corps, Dayton, Ohio.

Clement, David Scott, IV, '24 (B.T.C.). Chemist, Nashua Manufacturing Company, Nashua, N. H.

Cleveland, Richard Sumner, VI, '30 (B.T.E.). Textile Technologist, National Bureau of Standards, Department of Commerce, Washington, D. C.

Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.

Clogston, Raymond B., IV, '04 (D). Merrimack Manufacturing Company, Lowell, Mass.

Cluett, John Girvin, I, '29 (D). Foreman of Examining at Bleachery, Cluett, Peabody & Co., Inc., Waterford, N. Y.

Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.

Coffey, Daniel Joseph, III, '28 (D). Quality Man on Blankets, F. C. Huyck & Sons, Rensselaer, N. Y.

Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.

Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.

Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3006, New York City.

Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Assistant Superintendent, Hohokus Bleachery, Hohokus, N. J.

Cole, Edward Earle, IV, '06 (D).

Collonan, Herbert Joseph, II, '22 (D). College Weavers, Inc., Northampton, Mass.

Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.

Conant, Harold Wright, I, '09 (D). Assistant Treasurer, United Elastic Corporation, Easthampton, Mass.

Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears & Co., 65 Worth Street, New York City.

Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.

Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.

Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.

Connorton, John Joseph, Jr., III, '27 (D). Designer, Amoskeag Manufacturing Company, Manchester, N. H.

Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.

Corbett, James Francis, IV, '28 (B. T. C.). 74 Butman Road, Lowell, Mass.

Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.

Cowan, Raymond Bernard, IV, '35 (B.T.C.). Production Manager, Lebanon-Hope Garment Co., Pawtucket, R. I.

Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.

Craig, Clarence Eugene, III, '02 (D).

Crane, Eugene Francis, II, '33 (D). 517 Westford Street, Lowell, Mass.

Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.

Crowe, Joseph Bailey, IV, '25 (B.T.C.). Textile Chemist, Procter & Gamble Co., Ivorydale, Ohio.

Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.

Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, with Ralph E. Loper Co., Greenville, S. C.

Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.

Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.

Currier, John Alva, II, '01 (D). Superintendent of Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.

Curtin, William John, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Sterling, Conn.

Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.

Curtis, William Leavitt, II, '05 (C).

Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

Cuttle, James H., II, '99 (D). Vice-President and General Manager, S. Stroock & Co., Inc., Newburgh, N. Y.

Daley, Charles Lincoln, IV, '34 (B.T.C.). 239 Stevens Street, Lowell, Mass.
Dalton, Gregory Smith, IV, '12 (D).
Danahy, Arthur Joseph, IV, '31 (B.T.C.). Chemist, Ciba Company, Inc., 325 West Huron Avenue, Chicago, Ill.
Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.
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Dillon, James Henry, III, '05 (D).
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Goodhue, Amy Helen, IIIb, '00 (C). See Harrison, Mrs. Arthur.

Gooding, Francis Earle, IV, '19 (B.T.C.). Superintendent, Calco Chemical Company, Bound Brook, N. J.

Goosetrey, Arthur, IV, '21 (B.T.C.).

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Gross, Herman Peter, IV, '30 (B.T.C.). 94 Shanley Avenue, Newark, N. J.

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Hanscom, Edwin Thomas, II, '27 (D). Superintendent, Hartford Woolen Mills, Hartford, Vt.

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Harmon, Charles Francis, I, '99 (D).

Harrington, Thomas, IV, '15 (D). President, Hart & Harrington, 925 Weed Street, Chicago, Ill.

Harris, Charles Edward, I, '05 (D). Superintendent, Martin Rocking Fifth Wheel and Trailer Company, Westfield, Mass.

Harris, George Simmons, I, '02 (C). Treasurer, Springs Cotton Mills, Lancaster, N. C.

Harrison, Mrs. Arthur (Goodhue, Amy Helen), IIIb, '00 (C). R. F. D. No. 2, Lowell, Mass.

Hart, Arthur Norman, IV, '19 (B.T.C.).

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Meadows, William Ransom, I, '04 (D). Cotton Registrar, Chicago Board of Trade, Chicago, Ill.

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Nelson, Roy Clayton, II, '21 (C). Technical Superintendent, Assabet Mills, Maynard, Mass.
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Nostrand, Mrs. William L. (Conklin, Jennie Grace), IIIb, '05 (C).

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O'Donnell, John Delaney, I, '04 (C).
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Parkis, William Lawton, I, '09 (D). 32 Summit Street, South Manchester, Conn.

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Peabody, Roger Merrill, II, '16 (D). With Watson-Park Company, Ballardvale, Mass.

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Pease, Chester Chapin, I, '09 (D). Agent, Columbian Mills (Otis Company), Greenville, N. H.

Peck, Carroll Wilmot, IV, '13 (D). Vice-President, George Mann & Co., Inc., Providence, R. I.

Penney, Cabot William, III, '33 (D). Assistant Designer, Wyandotte Worsted Company, Pittsfield, Mass.

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Recher, Theodore, VI, '33 (B.T.E.). Salesman, R. Recher, Providence, R. I.
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Schoelzel, Herman Walter, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.

Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Assistant to Industrial Sales Manager, Tide Water Oil Company, Boston, Mass.

Schwarz, Herman Louis, IV, '22 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.

Scott, Gordon Maxwell, IV, '20 (B.T.C.).

Shaber, Hyman Jesse, VI, '17 (B.T.E.) (M.B.A., 1922, Harvard University.) With Spencer Chain Stores, Boston, Mass.

Shah, Shantilal Hiralal, IV, '34 (B.T.C.). Student, Harvard Business School, Boston, Mass.

Shain, Joseph, IV, '35 (B.T.C.). 41 Stanwood Street, Roxbury, Mass.

Shanahan, James Edward, II, '22 (D). Manager, Hygeia Ice & Coal Company, Amsterdam, N. Y.

Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C).

Shann, William Edwin, II, '35 (D). 169 Grove Street, Putnam, Conn.

Shapiro, Simon, VI, '34 (B.T.C.). Testing Laboratory, Gotham Silk Hosiery Company, Wharton, N. J.

Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.

Shea, John Francis, IV, '28 (B.T.C.). Demonstrator, Buffalo Electro-Chemical Co., Inc., 207 A Street, Boston, Mass.

Shedd, Jackson Ambrose, III, '28 (D). Designer, S. Stroock & Co., Inc., Newburgh, N. Y.

Shelton, Charles Leopold, VI, '29 (B.T.E.). Assistant to Merchandising Manager, Mohawk Carpet Mills, Amsterdam, N. Y.

Shenker, Nahman, III, '25 (D).

Sidebottom, Leon William, IV, '11 (D). Research Chemist, Boston Blacking & Chemical Company, East Cambridge, Mass.

Sjostrom, Carl Gustof Verner, Jr., III, '17 (D). Production Manager, Glastonbury Knitting Mills, Addison, Conn.

Slamin, Alfred Francis, I, '26 (D). Representative, Benjamin Franklin Paint Company, Philadelphia, Pa.

Sleeper, Robert Reid, IV, '00 (D). Textile Chemist, Calco Chemical Company, Bound Brook, N. J.

Smith, Allen Batterman, I, '26 (D). Turner Halsey Company, 40 Worth Street, New York City.

Smith, Doane White, II, '10 (D). 15 Oakland Street, Natick, Mass.

Smith, Frank Kenfield, II, '24 (D). Designer and Technician, Grout's, Ltd., St. Catharines, Ont.

Smith, Harold, IV, '34 (B.T.C.). Chemist and Bleacher, Wagner Hat Company, Haverhill, Mass.

Smith, Herbert Jeffers, VI, '22 (B.T.E.). 39 Sweet Avenue, Pawtucket, R. I.

Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.

Smith, Roger Dennis, II, '27 (D). Assistant Superintendent, M. T. Stevens & Sons Co. (Pentucket Mills), Haverhill, Mass.

Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.

Smith, William Charles, IV, '26 (B.T.C.). Chadwicks, N. Y.

Snelling, Fred Newman, II, '03 (D). With the American Railway Express Company, Haverhill, Mass.

Sokolsky, Henry, VI, '17 (B.T.E.). Time Study Supervisor, B. F. Sturtevant Company, Hyde Park, Mass.

Somers, Benjamin, II, '25 (D). 128 Pleasant Street, Brookline, Mass.

Southwick, Charles Hudson, IV, '22 (B.T.C.). Assistant Dyer, Slatersville Finishing Company, Slatersville, R. I.

Spalding, Arthur Ovila, IV, '32 (B.T.C.). 84 D Street, Lowell, Mass.

Spiegel, Edward, II, '03 (C).

Stacey, Alfred Charles, IV, '30 (B.T.C.). Chemist, Shoe Lace Company, Lawrence, Mass.

Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.

Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist and Overseer of Bleaching, Certified Laboratories, Inc., Austin, Texas.

Stass, John George, II, '27 (D). Textile Analyst, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.

Stearns, Kenneth Lawrence, IV, '33 (B.T.C.). Rayon Dyeing, Arnold Print Works, North Adams, Mass.

Steele, Everette Vernon, IV, '24 (B.T.C.). Purchasing Agent, Rohm & Haas Co., Inc., Philadelphia, Pa.

Stephens, Arnold George, I, '29 (D). Sales Service, Liberty Typewriter, Boston, Mass.

Stevens, Dexter, I, '04 (D). Vice-President and General Manager, The Esmond Mills, Esmond, R. I.

Stevens, Raymond Russell, IV, '19 (B.T.C.). Chief Chemist, The Felters Company, Inc., Millbury, Mass.

Stevens, William Edwin, I, '34 (D). With B. B. & R. Knight Corporation, (Royal Mill), River Point, R. I.

Stevenson, Murray Reid, III, '03 (C).

Stewart, Alexander, VI, '31 (B.T.E.). Inspector of Textiles, Quartermaster's Depot, Philadelphia, Pa.

Stewart, Arthur Andrew, II, '00 (D). Professor of Textiles; in charge of Finishing Department, Lowell Textile Institute, Lowell, Mass.

Stewart, John Weeden, IV, '30 (B.T.C.). Technical Demonstrator, General Dyestuff Corporation, 230 Fifth Avenue, New York City.

Stewart, Walter Lawrence, III, '03 (D).

Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Technical Adviser, Richards Chemical Works, Specialty Products Company, Onyx Oil & Chemical Co., Jersey City, N. J.

Stein, William Joseph, VI, '35 (B.T.E.). Textile Designer and Consultant, Hetzel & Gordon, 68 Leonard Street, New York City.

Stohn, Alexander Charles, III, '06 (C). General Superintendent, Carl Stohn, Inc., Hyde Park, Mass.

Stolzberg, Howard Nathaniel, IV, '35 (B.T.C.). Chemist, Suffolk Knitting Company, Lowell, Mass.

Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.

Storer, Francis Everett, II, '07 (D). Meredith, N. H.

Storey, Alvin Briggs, VI, '28 (B.T.E.). Assistant Superintendent, Textile Division, Celanese Corporation of America, Cumberland, Md.

Stott, John Smith, III, '28 (D). With Newmarket Manufacturing Company, Lowell, Mass.

Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.

Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, New Haven, Conn.

Sturtevant, Albert William, IV, '17 (D). Automobile Mechanic, Lowell Motor Sales, Inc., Lowell, Mass.

Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist and Technologist, Better Fabrics Testing Bureau, 225 West 34th Street, New York City.

Suhlke, Waldo Eric, IV, '20 (B.T.C.). Teacher, Jefferson Junior High School, Meriden, Conn.

Sullivan, John David, VI, '12 (D). With Robert Gair Company, Bradford, Mass.

Sullivan, Lambert William, II, '23 (D). With Southwell Wool Combing Company (Silesia Mills), North Chelmsford, Mass.

Sullivan, Willard David, II, '23 (D). 39 Loring Street, Lowell, Mass.

Sunbury, Herbert Ellsworth, VI, '18 (B.T.E.). Vice President, Allbestos Corporation, 21st & Godfrey Avenue, Germantown, Philadelphia, Pa.

Sutcliffe, Henry Mundell, II, '25 (D). Overseer, Uxbridge Worsted Company (Granite Mills), Pascoag, R. I.
Sutton, Leslie Emans, I, '17 (D). Superintendent, Anniston Cordage Company, Anniston, Ala.
Swain, Harry LeRoy, Jr., I, '26 (D). With Firestone Tire & Rubber Co., Akron, Ohio.
Swan, Guy Carleton, II, '06 (D). Chief Chemist, New York Food and Drug Inspection Station, 201 Varick Street, New York City.
Swanson, John Harold, I, '28 (D). Designer, Georgia Kincaid Mills, Griffin, Ga.
Sweeney, George Hamilton, II, '24 (D). Salesman, Walker Stetson Company, 157 Essex Street, Boston, Mass.
Swift, Edward Spooner, S. J., I, '02 (D). Clergyman, Church of the Immaculate Conception, Boston, Mass.
Syme, James Francis, II, '00 (D). Industrial Management, 27 Linnaean Street, Cambridge, Mass.
Symmes, Dean Whiting, IV, '22 (B.T.C.) Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

Tamulonis, Edward William, VI, '30 (B.T.E.). Second Hand, Newmarket Manufacturing Company, Lowell, Mass.
Tang, Hsiung-Yuan, I, '30 (D). Assistant Manager, Sung Sing Cotton Mill, No. 3, Wusih, Kiangsu, China.
Tarpey, Thomas Joseph, IV, '27 (B.T.C.). Chemist, National Aniline and Chemical Company, Buffalo, N. Y.
Tarshis, Elias Aaron, IV, '28 (B.T.C.). 801 Montgomery Street, Brooklyn, N. Y.
Teague, Charles Baird, II, '26 (D). Civil Engineer, Highway Division, Massachusetts Public Works Department, Boston, Mass.
Thaxter, Joseph Blake, Jr., II, '12 (D). Assistant Selling Agent, Ludlow Manufacturing Sales Corporation, 211 Congress Street, Boston, Mass.
Thomas, Benjamin, Jr., VI, '34 (B.T.E.). Overseer, Jackson Mills, Nashua, N. H.
Thomas, Robert Joseph, IV, '34 (B.T.C.). With The Apponaug Company, Apponaug, R. I.
Thomas, Roland Vincent, I, '05 (C). With Chicopee Sales Corporation, 40 Worth Street, New York City.
Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc., Charlotte, N. C.
Thompson, Everett Leander, I, '05 (D). Salesman, Tropical Paint and Oil Co., Cleveland, Ohio.
Thompson, George Robert, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Sterling, Conn.
Thompson, Henry James, IV, '00 (D). 15 Greenleaf Street, Malden, Mass.
Todd, Walter Ernest, III, '23 (D). Superintendent, Stanley Woolen Company, Uxbridge, Mass.
Toepler, Carl, IV, '22 (B.T.C.). Supervisor in charge of Finishing Department, Bellman Brook Bleachery Company, Fairview, N. J.
Toher, Francis Luke, IV, '32 (B.T.C.). 58 Concord Street, Providence, R. I.
Topjian, Leon, IV, '30 (B.T.C.).
Toshach, Reginald Alexander, II, '11 (D). Manager, Toshach's Mill Remnants, Haverhill, Mass.
Toupin, Stephane Frederick, VI, '24 (B.T.E.). Plant Engineer, Regent Knitting Mills, Ltd., St. Jerome, Quebec.
True, William Clifford, II, '22 (D). Industrial Engineer, Chelsea Fibre Mills, Inc., Brooklyn, N. Y.
Turcotte, David Henry, IV, '33 (B.T.C.). 523 Fletcher Street, Lowell, Mass.
Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Portsmouth, N. H.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.

Varnum, Arthur Clayton, II, '06 (D). Superintendent, Troy Blanket Mills, Troy, N. H.

Villa, Luis Jorge, IV, '25 (B.T.C.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

Villa, William Horace, VI, '24 (B.T.E.). Technical Director, Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

Villeneuve, Maurice Arthur, II, '26 (D). With Killingly Worsted Mills, Danielson, Conn.

Vincent, William Henry, III, '26 (D).

Walen, Ernest Dean, VI, '14 (B.T.E.). General Manager, Pacific Mills (Worsted Division), Lawrence, Mass.

Walker, Alfred Schuyler, II, '11 (D). 67 Park Avenue, Saranac Lake, N. Y.

Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.

Walker, Raymond Scott, II, '23 (D). Engineer, Wood Mills, Lawrence, Mass.

Walker, Samuel J., IV, '32 (B.T.C.). Cleaner and dyer, Merrivale Dry Cleaning Company, Lowell, Mass.

Wallace, Joseph Max, IV, '31 (B.T.C.).

Wang, Chen, IV, '23 (B. T. C.).

Wang, Cho, VI, '23 (B.T.E.).

Wang, Tung Chuan, VI, '23 (B.T.E.).

Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.

Wang, Yung Chi, II, '21 (D). Factory Manager, Ching Yuen Silk Mill, Shanghai, China.

Ward, George Chester, IV, '28 (B.T.C.). Research Chemist, Celanese Corporation of America, Cumberland, Md.

Warren, E. Maybelle, IV, '28 (B.T.C.). Chemist, Hub Hosiery Mills, Lowell, Mass.

Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

Washburn, John Milton, Jr., IV, '21 (B.T.C.). Salesman, Colgate-Palmolive-Peet Company, Boston, Mass.

Watson, William, III, '11 (D). Real Estate, Frank E. & Wm. Watson, 50–54 Merrimack Street, Haverhill, Mass.

Webber, Arthur Hammond, IV, '01 (D). Chemist and Colorist, L. B. Southwick & Co., Peabody, Mass.

Webster, Joseph Albert, VI, '23 (B.T.E.). Superintendent, Cloth Division, Aberfoyle Manufacturing Company, Chester, Pa.

Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.

Wells, Ai Edwin, VI, '20 (B.T.E.). Assistant Professor, Mechanical Engineering, Lowell Textile Institute, Lowell, Mass.

Wells, Henry Alfred, Jr., IV, '33 (B.T.C.). Chemist and Color Mixer, Warwick Print Works, Inc., Bound Brook, N. J.

Westaway, John Chester, VI, '28 (B.T.E.). Secretary-Treasurer, W. J. Westaway Co., Ltd., Hamilton, Ont.

Westbrooke, Clayton Collington, IV, '29 (B.T.C.). Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.

Wetherbee, Francis Putney, I, '28 (D). Plant Manager, Flint River Cotton Mills, Albany, Ga.

Wheaton, Walter Francis, VI, '23 (B.T.E.). Stationer, Walter F. Wheaton, White Plains, N. Y.

Wheelock, Stanley Herbert, II, '05 (D). President and Treasurer, Stanley Woolen Company, Uxbridge, Mass.

Whitcomb, Roscoe Myron, IV, '10 (D). Pharmacist, R. M. Whitcomb, Ashland, N. H.

White, Royal Phillip, II, '04 (D). Treasurer and General Manager, Amos Abbott Company, Dexter, Me.

Whitehill, Warren Hall, IV, '12 (D). Textile Chemist, Talbot Mills, North Billerica, Mass.

Wiech, Raymond Edward, IV, '29 (B.T.C.).

Wightman, William Henry, IV, '06 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
Wilcox, Leonard Edward, VI, '24 (B.T.E.). 49 Varnum Avenue, Lowell, Mass.
Wilkie, Robert Campbell, VI, '34 (B.T.E.). Wool Technician, Frosted Wool Process Company, Lowell, Mass.
Williams, Albert William, III, '32 (D). Designer, Amoskeag Manufacturing Company, Manchester, N. H.
Williamson, Douglas Franklin, I, '22 (D). Superintendent, Allred Plant, Granite Falls Manufacturing Company, Granite Falls, N. C.
Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.
Wing, Charles True, III, '02 (D). Paymaster, Merrimack Woolen Corporation, Dracut, Mass.
Wingate, Edward Lawrence, Jr., VI, '28 (B.T.E.). Service Manager, Russell Manufacturing Company, Middletown, Conn.
Wingate, William Henry, IV, '08 (D). Manager, Hodges Finishing Company, Dedham, Mass.
Wise, Paul Tower, II, '01 (D). Vice-President, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.
Wojas, Stanley Edward, IV, '33 (B.T.C.). Chemist, Massachusetts Mohair Plush Company, Lowell, Mass.
Woo, Tsunkwei, VI, '19 (B.T.E.).
Wood, Ernest Hadley, S.B., IV, '11 (D).
Wood, James Carleton, IV, '09 (D). Sales Representative, R. T. Vanderbilt Company, New York City.
Wood, Lawrence Burnham, IV, '17 (B.T.C.). Chemist, Pacific Print Works, Lawrence, Mass.
Woodbury, Kenneth Leroy, VI, '28 (B.T.E.). Sidney Blumenthal Company, Shelton, Conn.
Woodcock, Eugene Close, II, '07 (D). Mill Agent, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.
Woodhead, Joseph Arthur, VI, '23 (B.T.E.). 924–18th Street, Union City, N. J.
Woodies, Ida Alberta, IIIb, '00 (C). See Shananquet, Mrs. Lee.
Woodman, Harry Lincoln, I, '02 (C). Assistant Superintendent, Construction, Merrimac Chemical Company, Woburn, Mass.
Woodruff, Charles Beauregard, I, '06 (C).
Worthen, Clifford Tasker, IV, '22 (B.T.C.). Overseer, Dyeing and Bleaching, McLoughlin Textile Corporation, 203 Park Avenue, Utica, N. Y.
Wotkowicz, Michael Joseph, VI, '20 (B.T.E.).
Wright, Edward, II, '05 (C). Sanitary Engineer, Massachusetts Department of Public Health, 141 State House, Boston, Mass.
Wu, Clarence Wen-Lon, VI, '25 (B.T.E.).
Wu, Tsung-Chieh, VI, '25 (B.T.E.).
Wynn, William Joseph, Jr., IV, '34 (B.T.C.). Dyer, Wagner Hat Corporation, Haverhill, Mass.

Yavner, Harry, II, '12 (D). Merchant, Mayo's Hardware Company, Jamaica Plain, Mass.
Young, Edmund Joseph, Jr., IV, '33 (B.T.C.). Chief Chemist, Max Pollack & Co., Inc., Willimantic, Conn.
Yung, E-Zung, I, '32 (D). Assistant Manager, Sung Sing Cotton Mill No. 3, Wusih, Kiangsu, China.

Zalkind, Benjamin Joseph, VI, '29 (B.T.E.). Textile Engineer, Saco-Lowell Shops, Biddeford, Me.
Ziock, LeRoy, II, '25 (D). Vice-President and Superintendent, Ziock's Industries, Inc., Rockford, Ill.
Zisman, Louis Samuel, IV, '20 (B.T.C.). Head of Dyeing Department and Chief Chemist, Gotham Silk Hosiery Company, Inc., 580 First Avenue, New York City.

LOWELL TEXTILE INSTITUTE

APPLICATION FOR ADMISSION

THIS SHOULD BE FILLED OUT AND SENT TO THE REGISTRAR

Date......................

Name in Full..

Date and Place of Birth.......................................

Home Address { ....
City or Town *State*
....
Street and Number

INDICATE COURSE DESIRED

DEGREE COURSES

IV. Chemistry and Textile Coloring

VI. Textile Engineering

1. General Course
2. Cotton Option
3. Wool Option
4. Design Option
5. Sales Option

DIPLOMA COURSES

I. Cotton Manufacturing

II. Wool Manufacturing

III. Textile Design

Graduate of............................High School, Year 193......

Other High or Preparatory Schools attended 193...—193............

If you have done collegiate work, give name and address of college or university ....193...—193...

Signature ....

Signatures of..

Parents or
Guardian..

Citizen of ....
City or Town *State*

SERIES 39. NO. 4. May, 1936

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1936-1937

Entered August 26, 1902, at Lowell, Mass., as second-class matter
under Act of Congress of July 16, 1894

Moody Street and Colonial Avenue

DEPARTMENT
OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document approved by the Commission on Administration and Finance
2200. 6-'36. Order 7917.

LOWELL EVENING TEXTILE SCHOOL.

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1936.

September 24, Thursday	Registration.
October 1, Thursday	Registration.
October 5, Monday	Opening of evening school.
October 12, Monday	Columbus Day—Holiday.
November 11, Wednesday	Armistice Day—Holiday.
November 26, Thursday November 27, Friday	Thanksgiving recess. No classes.
December 18, Friday	End of first term.

1937.

January 4, Monday	Opening of second term.
February 22, Monday	Washington's Birthday—Holiday.
March 13, Friday	Closing of evening school.
April 6, Tuesday	Graduation.

OFFICERS OF INSTRUCTION AND ADMINISTRATION

Charles Holmes Eames, S.B. . . . . Billerica.
President.

Louis Atwell Olney, S.B., M.S., ScD. . . . 118 Riverside Street.
Professor of Chemistry; in charge of Department of Chemistry and Dyeing.

Edgar Harrison Barker . . . . 9 Mount Hope Street.
Professor of Textiles; in charge of Department of Wool Yarns.

Arthur Andrew Stewart . . . . 124 Luce Street.
Professor of Textiles; in charge of Department of Finishing.

Hermann Henry Bachmann . . . . . 146 Parkview Avenue.
Professor of Textile Design; in charge of Department of Design and Weaving.

Lester Howard Cushing, A.B., Ed.M. . . . 10 Walden Street.
Professor of History and Economics; in charge of Department of Languages, History and Economics; Secretary of the Faculty.

Herbert James Ball, S.B., B.C.S. . . . . 119 Wentworth Avenue.
Professor of Textile Engineering; in charge of Department of Textile Engineering and Accountancy.

Gilbert Roscoe Merrill, B.T.E. . . . . . 364 Varnum Avenue.
Professor of Textiles; in charge of Department of Cotton Yarns and Knitting.

Stewart Mackay . . . . North Chelmsford.
Assistant Professor of Textile Design.

John Charles Lowe, B.T.E. . . . . 161 Dracut Street.
Assistant Professor of Textiles.

Martin John Hoellrich . . . . 30 Saxonia Avenue, Lawrence.
Assistant Professor of Weaving.

Elmer Edward Fickett, B.S. . . . . . . 162 Hovey Street.
Assistant Professor of Analytical Chemistry.

Frederick Steere Beattie, Ph.B.. . . . . . 285 Foster Street.
Assistant Professor of Organic Chemistry.

Harold Canning Chapin, Ph.D. . . . . . 290 Pine Street.
Assistant Professor of General Chemistry.

Charles Lincoln Howarth, B.T.C. . . . . North Billerica.
Assistant Professor of Dyeing.

Percy Charles Judd, B.S. . . . . 156 Methuen Street.
Assistant Professor of Electrical Engineering.

Harry Chamberlain Brown, S.B. . . . . 272 Merrimack Street.
Assistant Professor of Physics and Mathematics.

James Guthrie Dow, A.B. . . . . 11 Robbins Street.
Assistant Professor of English.

Cornelius Leonard Glen . . . . . . R.F.D. No. 1, Lowell.
Assistant Professor of Finishing.

A. Edwin Wells, B.T.E. . . . 204 Franklin Street, Melrose Highlands.
Assistant Professor of Mechanical Engineering.

Russell Lee Brown, B.T.E. . . . . . 59 Bradstreet Avenue.
Assistant Professor of Textiles.

Charles Harrison Jack . . . . 71 Canton Street.
Instructor in Machine Shop Practice.

Ruth Foote, A.B., S.B. . . . . 46 Victoria Street
Instructor and Registrar.

Albert Greaves Sugden . . . . 673 School Street.
Instructor in Weaving.

Arthur Joseph Woodbury . . . . 41 Morey Street.
Instructor in Cotton Yarns.

Russell Metcalf Fox . . . . 359 Beacon Street.
Instructor in Textile Design.

Charles Arthur Everett, B.T.C. . . . . . . Chelmsford.
Instructor in Dyeing.

James Harrington Kennedy, Jr., B.T.E. . . . . . 177 A Street.
Instructor in Wool Yarns and Sorting.

William George Chace, Ph.B. . . . . . . 52 Tenth Street.
Instructor in Chemistry.

John Leslie Merrill, B.T.E. . . . . . 2026 Middlesex Street.

John Henry Skinkle, S.B. . . . . 52 Tenth Street
Instructor in Chemistry.
Franz Evron Baker, B.T.E. . . . Dalton Road, Chelmsford.
Instructor in Cotton Yarns.
Charles Frederick Edlund, B.S. . . . 272 Merrimack Street.
Instructor in Sales Engineering.
Milton Hindle, B.T.E. . . 24 Highland Avenue, Melrose Highlands.
Instructor in Mechanical Drawing.
Horton Brown, B.S. . . . . . 178 Atlantic Avenue, Marblehead.
Instructor in Mathematics.
Elmer Percy Trevors . . . . . . 18 Rhodora Street.
Assistant Instructor in Chemistry.
Paul David Petterson . . . . . . East Chelmsford.
Assistant Instructor in Machine Shop Practice.
De Gruchy, James Campbell . . . 61 Pleasant Street, Stoneham
Student Instructor in Chemistry.
Robert Frederick Jessen . . . . . 298 Pawtucket Street.
Student Instructor in Cotton Yarns.
Emilio Gomez Moreno, Jr. . . . . Graniteville.
Student Instructor in Mechanical Drawing.
Lee Gale Johnston . . . . Haverhill.
Student Instructor in Chemistry.
Walter Ballard Holt . . . . . . 37 Albert Street.
Bursar.
Florence Moore Lancey . . . . . . 46 Victoria Street.
Librarian.
Helen Gray Flack, S.B. . . . . . . 445 Stevens Street.
Secretary.
Mona Blanche Palmer . . . . . . 685 Westford Street.
Clerk.
Miriam Kaplan Hoffman, S.B. . . . . 43 Hawthorn Street
Clerk.
Howard Dexter Smith, Ph.D. . . . . Dalton Road, Chelmsford.
Evening Instructor in General Chemistry.
Harold Arthur Giffin . . . . . . 785 Stevens Street.
Evening Instructor in Design.
Edward W. Dooley . . . . . . 799 Chelmsford Street.
Evening Instructor in Advertising Design.
Vittoria Rosatto . . . . . . 63 Bradstreet Avenue.
Evening Instructor in Art.
J. Raymond Bradley . . . . 45 Kirke Street.
Evening Instructor in Advertising Design.
James C. Buzzell . . . . . . 100 Park Avenue, East.
Evening Instructor in Electricity.
Glen Bowden Caswell, ... 32 Hampshire Street.
Evening Instructor in Machine Shop.
Bertha C. Hoellrich . . . . . . 99 Park Street, Newton.
Evening Instructor in Art.
Frederick William Gatenby, ... Forge Village.
Evening Instructor in Worsted Yarns.
Donald L. Hemmenway . . . . . . 55 Norcross Street.
Evening Instructor in Electricity.
Inez L. Keller . . . . . . 22 Chestnut Street, Winchester.
Evening Instructor in Art.
Ivar O. Moberg . . . . 64 Thirteenth Street.
Evening Instructor in Weaving.
Margaret L. Smith . . . . 62 Florence Avenue.
Evening Instructor in Art.
John L. Dolan . . . . 173 Pleasant Street.
Evening Instructor in Mathematics.
Edward L. Golec . . . . 72 Hampshire Street.
Evening Instructor in Design.

EVENING CLASSES

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

The course in Organization, which is offered only to those who have completed the work in Carding and Spinning, is a relatively new course given in response to a demand for this type of instruction.

110. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used and the production of each process as well as the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the control of waste.

Two evenings each week.

Cotton.—Before taking up the details of manufacturing cotton into yarn, a careful study of its physical characteristics is made. The geographical distribution of the areas producing commercial cottons is explained and the characteristics of the cottons produced in each are studied. A general explanation of the cultivation and harvesting of cotton is made, especially emphasizing the effect of agricultural factors on the cotton fiber and how these may serve to complicate manufacturing problems.

The ginning of cotton is considered, showing the yield of lint, the uses of cotton seed and the various types of gins and which cottons are commonly ginned on each.

The intricate system of buying and selling cotton is studied to illustrate the problems a mill may meet in procuring cotton. In this connection, special emphasis is placed on the classification of cottons by staple, grade and character.

Opening and Picking.—Instruction in the preliminary operation of opening and picking covers the mechanical construction of the machines, their parts and adjustments, as fully as the manufacturing results accomplished by the machines. This includes such construction details as evener, lap measuring and safety stop

motions, grids, cleaning trunks and beaters, also operation details which involve the adjustment for waste, drafts and character of laps. Some time is devoted to mixing in its various phases, showing in addition to improvement in uniformity of the product, how cottons are mixed to obtain definite average prices and how different percentages of color may be obtained by mixing, expecially on the pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, spooling, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper attention is paid to such subjects as stop motions, drawing rolls and their covering, clearers and evener motions.

Roving Process.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use.

Ring Spinning.—The consideration of spinning yarn by the ring frame method involves a knowledge of the uses to which the yarn is to be put and subsequent methods of handling, that proper roving may be selected, suitable amounts of draft and twist provided, correct size of rings and travelers selected, and building motions suitably adjusted. Yarn defects are studied with reference to the cause and remedy, necessitating references to many of the earlier operations.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns is taken up here. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

114. Cotton Organization—1 Year.

The course in Organization is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

210. Worsted Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc., also a course in carding and the calculations involved in the mechanism of the machines, and a course covering gilling and combing and the processes of top making.

Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, would include silk, mohair, alpaca, vicuna, cashmere, camel's hair and cotton. In connection with these are considered shoddy, noils and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture. The various characteristics and properties are explained, as are also trade terms, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of soaps and chemicals used in washing; also the waste products and their utilization. A demonstration of a commercial quantity of wool is scoured by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap. At the same time the use of driers, their operation and regulation, is taken up, and the methods of carbonizing wool, noils, burr waste, rags, etc., are studied and explained.

Carding.—The different types of worsted cards are fully explained, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application and grinding.

Top Making and Combing.—This branch takes up, besides the carding of the wool on a worsted card, the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures. Later, quantities of stock are made into top.

Three evenings each week.

The *second year* is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

211. Woolen Yarns—2 Years.

During the *first year* instruction consists of a lecture course on the various kinds of wool fibers, trade terms, sorting, scouring, carbonizing, etc.

One evening each week.

The *second year* covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Two evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the

cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and

drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT

510. English Composition—2 Years.

Remedial English and Rhetoric—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

Problems in the Interpretation and the Appreciation of Literature—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

For one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint, the course in Mechanical Drawing is offered. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

This course is a complete course in drawing and requires *two evenings per week* for three years for its completion. The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete. The time required is *two evenings each week.*

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires attendance *two evenings each week* with home problem work and the study of a text book.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further by evening study the mathematics of his grammar or junior high school course. It includes algebra, elementary trigonometry, logarithms and slide rule, and requires attendance for *two evenings each week.* It should be taken by all who intend to study further into engineering subjects. Instruction is largely through problem work in class and at home, and the use of a text book.

Some of the topics treated are—

Elementary algebraic operations of—

- Addition.
- Subtraction.
- Multiplication.
- Division.
- Factoring.
- Fractions.
- Graphical representation.
- Linear equations.
- Radicals.
- Quadratic equations.
- Logarithms.
- Slide rule.
- Trigonometry

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The time required is *two evenings each week* and the method of instruction is through lectures, recitations, problems, and the use of a text book.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used, requiring an attendance of *two evenings each week.*

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. It requires for its completion attendance for *two evenings each week* and a considerable amount of home study and preparation. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work. An attendance of *two evenings each week* is required.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated.

A test book is required and the class is held *two evenings each week.*

626. Mill Illumination—1 Year.

Because of the demand by mill men, this course is now offered to evening students and requires an attendance of *two evenings each week.*

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

629. Selling, Advertising, and Marketing—1 Year.

An elementary course designed to acquaint the student with the principles involved in the distribution and merchandising of textiles and other commodities.

The course is given in two parts. One evening a week the principles underlying salesmanship and advertising are studied. The other evening is devoted to a study of marketing principles and practice. Both parts must be taken in order to secure a certificate.

The selling and advertising section deals with the psychology of selling and advertising, copy writing, layout, illustrations, mechanical requirements of copy and illustration, advertising campaigns, personality, types of customers, the selling process, dramatization, etc.

The marketing section covers modern methods of distributing goods with special emphasis on the textile industry. The functions and importance of selling agents, brokers, converters, wholesalers, factors, retailers and other intermediaries in the channels of distribution are studied as well as the fundamentals of styling, market research, pricing, forecasting, retailing, wholesaling, and other pertinent topics.

The material is presented by means of lectures and class discussions and assigned problems. An attendance of *two evenings each week* is required.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. The requirements are attendance *two evenings each week* with home problem work and the study of a text book.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In these courses machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. These courses also help the finisher to broaden his knowledge of textile fabrics. Attendance is required for *two evenings each week.*

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1935.

Certificates awarded as follows, April 21, 1936:

Cotton Yarns—2 Years.

Herman Edward Colby	Lawrence
Leo Napoleon Cyr	Lowell
George Preston Henken, Jr.	Salem
Heman Burns Hunter	Salem
Rene Albert Lizotte	Newton
Earl West Moreland	Salem
Chester Steven Williamson	Lowell

Cotton Organization—1 Year.

Bernard Francis Brady	Lowell
Albert Richard Dudley	Lowell
William Endicott, 2nd	Boston
Karl Frederick Gustav Maier, Jr.	Lowell
Elwyn Warren Mitchell	Methuen
Perley Hill Shaw	Nashua, N. H.
Herbert MacWhinnie Weymouth	Nashua, N. H.

Woolen Yarns—2 Years.

Verne Walter Violet	Maynard

Worsted Yarns—2 Years.

Herbert Foster Bowen	Lowell
George James Green	Everett
Seville Hargreaves	Methuen
John Malcolm Milne	Winthrop
Thomas Bernard Murray	Lawrence
E. Geoffrey Nathan	Brookline
George Washington Pihl	Lowell
Walter Frederick Preston	Lowell
George Olney Steere	Methuen
Alexander Vervaert	Lowell

Cotton Design—3 Years.

William Joseph Beauchesne	Lawrence
Harry Robert Buckley	Lawrence
Robert Theodore Charlton, Jr.	Lowell
Norman Garlington	Lawrence
Samuel Royce McMaster	Lowell
Lionel Donat Turcotte	Lowell

Woolen and Worsted Design—3 Years.

Arthur Bernard Charlesworth	Methuen
Raymond Stoddard Cheney	Lawrence
Nunzio Vincent Ciccarelli	Lawrence
George Frederick Cohen	Lawrence
Rufus Edward Corlew	Lowell
Martin William Eichhorn, Jr.	Methuen
Bert Gilbert	Methuen
William Dixon Glennie	North Andover
Arthur Stephenson Howatt	Lowell
Joseph Edgar Jalbert	Lowell
Arthur Thomas Little	Methuen
Harold Norman Logan	Lowell
Walter Stoddart MacLauchlan	Methuen
Arthur John Mueller	Lawrence
Dennis Joseph Murphy	Lowell

Richard Holden Olney	Lowell
Charles Henry Redman	Lowell
Benjamin Booth Ross	Lawrence
Benjamin Franklin Savage, Jr.	Lowell

Decorative Art—3 Years.

Paul Peter Bruzzo	Lawrence
Inez Muriel Descoteau	Lowell
Paul Gilbert Desilets	Lowell
Philippe Alphonse Goyette	Lowell
Marie Jeannette Guimond	Lowell
Thomas Patrick McDevitt	Lowell
Blanche Rose O'Brien	Lowell
Helen Elizabeth Oulighan	Lowell
Lauretta Irene Tellier	Lowell

Advertising Design—2 Years.

Henry Denomme	Lowell
Grace Gertrude Handley	Lowell
Ernest George Pratt	Lowell
Ingrid Israella Robinson	Lowell
Ernest Alfred Sauvageau	Lowell

Cotton Weaving—1 Year.

Andrew Joseph Brouillette	Lowell
Raymond Brunet	Lowell
Edward Bernard Dapontes	Lowell
Emma Francisco	Lowell
Mary Francisco	Lowell
Walter Frank Gacek	Lowell
Louis Theodore Montminy	Lowell
Charles August Ouellett	Lowell
Florence Neves	Lowell
Lucien Albert Vallerand	Lowell

Woolen and Worsted Weaving—1 Year.

Oscar Peter Arsenault	Lawrence
Albert Bourgeault	Lowell
Andrew Joseph Brouillette	Lowell
William Joseph Chenard	Lowell
John Christison	Methuen
Thomas Clegg	Lowell
Percy Harold Croft	Maynard
Joseph Arthur Dumond	Lawrence
James Gordon Fettes	Andover
Dana Pierce Fisher	Methuen
James Joseph Foye	Lowell
Raymond Armand Francoeur	Lowell
Walter Frank Gacek	Lowell
Frank John Garfi	Lawrence
Ignatius James Hobitz, Jr.	Lawrence
Raymond Houle	Methuen
Arre Arnold Huhtamaki	Maynard
Urho Katvala	Maynard
Kauko Luoto	Maynard
William Paul McCarthy	Lowell
Philip James Murray	Methuen
Peter James Myers	Andover
Joseph Ralph Nesbitt	Lawrence
Arvi Ero Norgoal	Maynard

Waino John Norgoal	Maynard
Joseph William Novello	Lawrence
James Pappadopoulos	Lowell
Walter Piaulok	Lawrence
Charles Julius Savosh	Maynard
Thomas James Seamans	Lowell
George Olney Steere	Methuen
Andrew Wolkowich	Graniteville
Vasilo Zouvelos	Lowell

Loom Fixing—1 Year.

Conrad Joseph Bernier	Lawrence
John Arthur Charnock	Lawrence
William Joseph Chenard	Lowell
Charles Edward Coffey, Jr.	North Billerica
David Alexander Stirling Doig	Andover
George Emile Dumond	Lawrence
Michael Joseph Gillespie	Arlington
William Longworth	Methuen
Harold Alexander Payson	North Andover
William Joseph Poirier	Lawrence
Stanley Anthony Smigiel	Lowell
Alexander Thomson	North Andover
Charles Lewis Valentine	Andover

Woolen and Worsted Finishing—1 Year

Albert Binns	Methuen
Harry Binns	Methuen
George Assaf Caram	Medway
Fred C. Couto	Lawrence
Archibald Lamb Davidson, Jr.	Andover
Joseph Nathaniel Duckett	Lawrence
Stephen Augustine Hayes	Lawrence
Alphonse Julis Kasheta	Lawrence
John Richard Micka	Lawrence
Vincent William Mizeras	Lawrence
Harold Mudd	Lawrence
Paul Vincent O'Reilly	Lawrence
Henry Rossi	Lawrence
Earl Frederick Schubert	Methuen
Samuel Asa Stubbs	Chelmsford

Elementary Chemistry—2 Years.

Edward Francis Blinkhorn	Lowell
George Blyth, Jr.	Lawrence
Stanley Wendell Brown	North Andover
James Edward Cummings	Lowell
Hildegard Monson Dahlstrom	Lowell
Alfred John Demers	Lawrence
Philip Demetri Evangelos	North Andover
Paul Stuart Finneral	Lowell
Warren Franklyn Halstead	Methuen
Guy Sargent Haynes	Haverhill
Mary Cecilia Hickson	Lowell
Kenneth Richard Hill	West Chelmsford
Russell Hodge	Lawrence
Bernard Charles Jackson	Methuen
Edward Francis Mickolus	Lawrence
Philip Butler Midgley	Lowell
Kenneth Stuart Moore	Lawrence

George William Murray	Lowell
Donald Raymond Neil	Lowell
Arthur Joseph Noel, Jr.	Lowell
Howard Cecil Richardson	North Andover
George Edward Stubbs	Chelmsford
Thomas William Sugden, Jr.	Tyngsboro

Textile Chemistry and Dyeing—3 Years.

Benjamin Wade Ambler	Chelmsford
Charles Peter Averka	Lawrence
Harry Fraser Holmes	Ipswich

Analytical Chemistry—3 Years.

Albert Francis Haley	Haverhill
Michael Herbert McHale	Lawrence
Edward George Maguire	Bradford
Douglas O'Brien Mahoney	Lawrence

Mechanical Drawing—3 Years.

Herbert Gustave Galle	Methuen
Leo Anthony Gaudet	Andover
Alexander Joseph Graham	Lowell
George Daniel Hmurciak	Lawrence
Paul Eugene Longval	Lowell
Ely Alfred Martel	Lowell
John Francis Moynihan	Lawrence
Lloyd Arnold Wilson	Methuen

Direct Current Electricity—2 Years.

Lawrence Francis Gauthier	Nashua, N. H.
Frank Kayros	Hudson, N. H.
Stanley Kayros	Hudson, N. H.
Frank Joseph Shore	Lowell
Lloyd Arnold Wilson	Methuen

Machine Shop Practice—2 Years.

Joseph Edward Connolly	Lowell
Herbert James Fletcher	Tewksbury
Aime Bernard Hamel	East Chelmsford
Peter Kayros	Hudson, N. H.
Thaddeus John Leczynski	Dracut
Reuel Arthur MacLaughlin	Lowell
Francis Joseph Rene	Lowell
Kenneth Chase Trufant	Nashua, N. H.

Mathematics—2 Years.

Arthur Huntley Cady	Hudson, N. H.
John Charles Collins	Lawrence
Robert Helair Dupuis	Lowell
Herbert Theodore Knutson	Lowell
Ralph Francis Lally	Lowell
John Joseph Linnehan, Jr.	Lowell
Evangelos George Pappadopoulos	Lowell
Stanley Shaw	Lowell
William Edward Wood	Lowell
George Edward Woodger	Nashua, N. H.

Steam—1 Year.

George Gordon Armstrong, Jr.	Littleton
Patrick Francis Comer	Lowell
Albert Allen Denio	Lowell
Harry Fjeld Halvorsen	Chelmsford
Charles Joseph Murray	Lowell

Mechanics—1 Year.

Cyril Feugill, Jr.	Methuen
Richard Lee Monahan	West Chelmsford

Selling, Advertising and Marketing—1 Year.

Raymond Arthur Brodeur	Lowell
Charles William Colitses	Lowell
John Joseph Conway	Lowell
Irene Delaney	Lowell
Vincent Walsh Dudevoir	Forge Village
George James Dyer	Lowell
Alice Margaret Harrington	Lowell
Manuel Placid Jesus	Lowell
Gerard Jussaume	Lowell
William Knowles	North Andover
Thomas Harris Lauzon	Lowell
Allan Daniel McQuarrie	Lowell
Thomas Joseph McShane	Lowell
Thomas Joseph Murphy, Jr.	Lowell
William Joseph Murphy	Lowell
Dorothy Murray	Lowell
Rita Antoinette Perreault	Lowell
David Ruxton Petrie	Andover
Joseph John Sztura	Lawrence

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A COMPARATIVE STUDY OF TENSILE AND DIRECTED BURSTING STRENGTH TESTS OF WOVEN FABRICS

The material for this paper is taken from an undergraduate thesis performed under the direction of the Textile Engineering Department by E. H. Bradford, 1935, as a partial requirement for the degree of Bachelor of Textile Engineering.

The purpose of the thesis was to determine whether ravel-strip tests, grab tests, and directed bursting strength tests would give similar indications as to the relative strengths of woven fabrics. It was also intended to determine whether these tests would disclose similar information in regard to the relative variability in strength of the same fabrics.

The ravel-strip and grab tests were of the type described in Standard General Methods of Testing Woven Textile Fabrics (D 39) of the American Society of Testing Materials and require little special comment.

The directed bursting strength tests were made on a bursting strength tester of the diaphragm type in which the tripod with the usual hollow circular base was replaced with one of special design. The shape of its base was a hollow square, two opposite sides of which were cut away so that they could exert no pressure on the fabric and therefore leaving the yarns passing under them free to move as the diaphragm extended. The other two sides of the base which had not been cut away gripped the set of yarns at right angles to the first, thereby preventing their free movement, and thus directing or throwing the bursting load on to them. By properly placing the specimen under a base of this design, it was possible to predetermine whether the warp or filling yarns would be broken. This is in distinct contrast to the effect of the circular base which, gripping both sets of yarns, leaves it to the extending diaphragm to seek out the weaker set and cause its rupture.

Three cotton cloths, hereafter referred to as Fabrics A, B and C respectively, were selected for the tests. Fabric A was an unfinished print cloth, weighing 2.9 ounces per square yard, and woven with 64 ends and 60 picks per inch. Fabric B was an unfinished shoe drill, weighing 7.8 ounces per square yard, and having 86 ends and 42 picks per inch. Fabric C was an army duck, weighing 8.9 ounces per square yard, and having 56 ends and 42 picks per inch.

One hundred warp and one hundred filling specimens were prepared from each fabric and for each type of test. The size of the strip test specimen was 7″ long by 1½″ wide, later ravelled down to exactly 1″ in width. The grab test specimen was 6″ long by 4″ wide, and the specimen for the bursting test was 3″ square. The specimens were cut from the cloth in sets of three, one for each type of test, and so placed as to contain the same set of warp or filling threads. They were conditioned for at least three hours before testing in a room where the relative humidity was automatically maintained at 65 ± 2%.

The results of the tests are given in Table I. The averages of the bursting strength tests have been corrected for diaphragm pressure, that is, the pressure required to extend the diaphragm only. The average deviation was selected as a measure of variability in strength and is stated in pounds and as a per cent of the mean.

A study of the data shows that the three types of tests rate the fabrics in the same order on the basis of strength and give the same general indications of the magnitude of the differences in strength. It will also be observed that these tests rate the fabrics in the same order in respect to variability in strength with only one exception in six cases, namely, the bursting test on the filling of Fabric B.

TABLE I

	Strip Test		*Grab Test*		*Bursting Test*	
Fabric	Warp	Filling	Warp	Filling	Warp	Filling
MEAN BREAKING STRENGTH IN POUNDS						
A	40.8	24.9	46.6	27.7	65.4	49.5
B	110.2	83.6	136.4	94.6	206.9	152.7
C	115.2	97.8	168.4	124.2	235.1	169.9
AVERAGE DEVIATION IN POUNDS						
A	1.8	1.7	1.9	2.0	3.1	2.4
B	3.6	4.4	3.6	5.4	8.4	8.5
C	5.0	4.8	5.4	6.6	13.8	6.8
AVERAGE DEVIATION—PER CENT OF MEAN						
A	4.4	6.8	4.1	7.2	4.7	5.2
B	3.3	5.3	2.6	5.7	4.1	5.6
C	4.3	4.9	3.2	5.3	5.9	4.0

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THE DETERMINATION OF WOOL AND MOHAIR BY SCALE SIZE AND DIAMETER*

By JOHN H. SKINKLE, S.B.
Instructor in Chemistry, Lowell Textile Institute

Note: This paper was presented at the last meeting of the American Association of Textile Chemists and Colorists as a contribution from the Sub-Committee on the Separation of Fibers of which Mr. Skinkle is a member.

Mr. Skinkle's method has been carefully checked by other workers, and we quote from the report of one prominent textile laboratory which has made a special study of the separation of mohair and other animal fibers.

"We believe that Mr. Skinkle's method is a distinct contribution to laboratory procedure. We took what we consider the most difficult problem we have, used the proposed method and find that it does what is claimed."

It is hoped that others will try out this method, and Mr. Skinkle will welcome any criticism that may arise.

DR. LOUIS A. OLNEY

One of the most difficult determinations in textile microscopy is to decide with certainty whether a given sample of hair fiber is wool or mohair. In the case of a typical wool or a typical mohair, the identification is fairly easy on qualitative examination alone, the presence or absence of serrated outline being the most prominent distinction; in the cases of border-line samples, such as some of the carpet wools or the luster wools, the qualitative examination is uncertain; certain chemical treatments tend to alter the outlines of the fibers and make the determination even more uncertain; lastly, the coarser and more hairy fibers of both kinds are easily confused. A quantitative determination is usually more certain and requires less experience on the part of the observer. Hanausek† recommends the use of scale length in the identification of hairs and gives values for wool of 8.3 to 10.3 microns per scale and a single value of 18.9 microns for mohair, but in the author's experience these values are unreliable in the case of wool and insufficient in the case of mohair. This work was undertaken, therefore, to obtain information as to whether scale size is critical enough for identification, to extend the range of values, and to see whether any other measurement or group of measurements might aid in identification.

According to Hanausek, the scale length of hairs is quite uniform except that it increases toward the tip of the fiber. In order to verify this, three widely differing wools and one mohair were tested for scale length and diameter at three places on each fiber, the average of ten to twenty fibers being obtained. The results of these measurements are given in Table I. It may be seen that two of the scale lengths always check and that in most cases the tip ends have lower scale lengths than the middle or root ends; this is contrary to Hanausek's statement. In the work subsequent to this, all measurements were taken near the middle of the fibers.

* Published simultaneously in American Dyestuff Reporter.

† Hanausek, T. F.—Winton, K. B., "Microscopy of Technical Products," John Wiley & Sons, Inc., New York, 1907.

In determining the scale length and diameter of the various samples, determinations were made on twenty fibers mounted in mineral oil, but since each determination was made by noting the length of a series of several scales and then dividing by the number of scales, the total number of scales measured for each sample is from sixty to one hundred. The values obtained were quite uniform and so a larger number of determinations was not thought necessary. The diameters were measured at the same points as the scale length. The samples tested included carpet wools and luster wools since these are the wools usually confused with mohair. The values of scale length (S), diameter (D), and the value S^3/D are given in Table II.

From Table II, the following facts may be noted:—

1. S is above 18 for all mohairs and below 18 for all wools.
2. All but two wools are below 17 and all but two mohairs are 18.5 or above.

TABLE I

Effect of Position on Hair on Scale Size and Diameter

Sample	Position	Diameter —microns	Scale length —microns
Coarse wool	Root end	129	19.2
Coarse wool	Middle	105	17.9
Coarse wool	Tip end	93	17.8
South American wool	Root end	35.2	15.3
South American wool	Middle	36.3	15.5
South American wool	Tip end	27.5	13.2
Fine wool	Root end	29.8	15.7
Fine wool	Middle	27.5	15.2
Fine wool	Tip end	25.3	13.5
Mohair No. 1	Root end	43.4	18.9
Mohair No. 1	Middle	40.5	18.7
Mohair No. 1	Tip end	37.2	18.5

TABLE II

Scale Sizes and Diameters of Various Wools and Mohairs

Wools:	D=diameter —microns	S=scale length —microns	S^3/D
⅜ blood	31.0	12.7	66
Sicilian, washed	22.2	13.2	104
¼ blood	47.0	13.3	50
Coarse, 5's B. A.	41.2	14.4	73
Aleppo, Syria	38.3	14.6	81
China boll	20.3	15.0	166
English luster	38.6	15.0	88
Fine	27.5	15.2	128
South American	36.3	15.5	103
Luster	42.3	16.8	108
New Zealand cross-bred	37.0	17.2	138
Very coarse	105.0	17.9	55
Mohairs:			
Low, stained	36.8	18.1	161
Mohair No. 2	35.9	18.2	168
Mohair No. 3	27.3	18.5	232
Coarse	44.2	18.5	143
Mohair No. 1	40.5	18.7	161
Mohair beards	59.7	19.1	117
Cape Kid	39.4	20.2	209
Super Kid	28.6	21.6	352

3. S^3/D is below 140 for all wools except one, and above 160 for all mohairs except two.

In the identification of a hair as either wool or mohair, the following cases may exist:

A. The value of S is below 17.0; the hair is wool.

B. The value of S is above 18.5; the hair is mohair.

C. The value of S is between 17.0 and 18.0; the hair is probably wool, verify by calculating S^3/D, if this value is below 140 the hair is wool.

D. The value of S is between 18.0 and 18.5; the hair is probably mohair, verify by calculating S^3/D, if this value is above 160 the hair is mohair.

As yet, no cases have arisen in the experience of the author or his students which do not fall into one of the above classes but it is possible that wools may turn up with a value of S slightly above 18 but with a value of S^3/D or less than 140; such cases might cause revision of the border-line values quoted **above.**

Southwick Hall

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Moody Street and Colonial Avenue

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CALENDAR

1936–1937

September 10–11, Thursday–Friday	Entrance Examinations
September 14–19, Monday–Saturday	Re-examinations
September 17, Thursday, 9.00 A.M.	Registration for Freshmen
September 21, Monday	Registration for upper-class students Classes begin for Freshmen
September 22, Tuesday	Classes begin for upper-class students
October 12, Monday	Columbus Day — Holiday
November 11, Wednesday	Armistice Day — Holiday
November 24, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 30, Monday, 9.00 A.M.	Thanksgiving recess ends
December 18, Friday, 4.45 P.M.	Christmas recess begins
January 4, Monday, 9.00 A.M.	Christmas recess ends
January 18, Monday	First term examinations begin
January 29, Friday	End of first term
February 1, Monday	Second term begins
February 22, Monday	Washington's Birthday — Holiday
April 16, Friday, 4.45 P.M.	Spring recess begins
April 26, Monday, 9.00 A.M.	Spring recess ends
May 24, Monday	Second term examinations begin
May 31, Monday	Holiday — Observance of Memorial Day
June 8, Tuesday	Commencement
June 10–11, Thursday–Friday	Entrance Examinations

1937–1938

September 9–10, Thursday–Friday	Entrance Examinations
September 13–18, Monday–Saturday	Re-examinations
September 16, Thursday, 9.00 A.M.	Registration for Freshmen
September 20, Monday	Registration for upper-class students Classes begin for Freshmen
September 21, Tuesday	Classes begin for upper-class students
October 12, Tuesday	Columbus Day — Holiday
November 11, Thursday	Armistice Day — Holiday
November 23, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 29, Monday, 9.00 A.M.	Thanksgiving recess ends
December 17, Friday, 4.45 P.M.	Christmas recess begins
January 3, Monday, 9.00 A.M.	Christmas recess ends
January 17, Monday	First term examinations begin
January 28, Friday	End of first term
January 31, Monday	Second term begins
February 22, Tuesday	Washington's Birthday — Holiday
April 13, Wednesday, 4.45 P.M.	Spring recess begins
April 20, Thursday, 9.00 A.M.	Spring recess ends
May 23, Monday	Second-term examniations begin
May 30, Monday	Memorial Day — Holiday
June 7, Tuesday	Commencement
June 9–10, Thursday–Friday	Entrance Examinations

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Paul David Petterson . . . . East Chelmsford
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Student Instructor in Chemistry
Hugh Francis Carroll . . . . 600 High Street, Medford
Student Instructor in Chemistry
Robert Miller Kennedy . . . . Dunstable
Student Instructor in Mechanical Drawing
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Student Instructor in Cotton Yarns
Walter Ballard Holt . . . . 37 Albert Street
Bursar
Florence Moore Lancey . . . . 46 Victoria Street
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Mona Blanche Palmer . . . . 685 Westford Street
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Clerk

HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had in charge the work of construction. The building completes the fourth side of the quadrangle, and in outward appearance corresponds to the architectural features of the other school buildings. It is a single-story building, and has the dimensions of 195 by 60 feet. Its interior is faced with cement brick made at the school during the progress of the

work. These serve to give light-reflecting walls which are advantageous for the work of the Wool Manufacturing, Cotton Finishing and Chemistry and Dyeing Departments that occupy this building. The funds for this building were provided by the State of Massachusetts.

The buildings are of modern mill construction adapted to educational uses and contain approximately 181,294 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Bcard or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	11

Elective Subjects

	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
	9

Elective Subjects

Four may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 10, 1937; Thursday, September 9, 1937; Thursday, June 9, 1938:—

Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 11, 1937; Friday, September 10, 1937; Friday, June 10, 1938:—

Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.

Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students shall be the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential

subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 16, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a

statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—For all first-year students a minimum deposit of $25 is required to cover the cost of breakage, supplies, apparatus and chemicals used in the Chemical Laboratory, the unexpended balance to be returned to the student at the end of the year. For all students in second, third, and fourth years taking work in Chemistry and Dyeing Laboratories a deposit of $25 for the first term and $25 for the second term is required.

Students taking Machine Shop will be required to make deposit of $10 to cover cost of materials, supplies and breakage, the unexpended balance to be returned at the end of the year.

Students not taking Chemistry Laboratory or Machine Shop will be required to make a deposit of $10 each year to cover general breakage. The unexpended balance will be returned at the end of the year.

All deposits must be made before students can be admitted for laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop.)	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

SCHOLARSHIPS AND PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Section of the American Society of Dyers and Colorists hold meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. —A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1936–37

Harold W. Leitch, '14, *President*
E. Dean Walen, '14, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*
A. Edwin Wells, '20, *Assistant Secretary*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Ex-Officio Members of Executive Committee

Thomas T. Clark, '10
Stanley H. Wheelock, '05

Executive Committee
15 *Members*

Roy H. Bradford, '06
Alexander Campbell, '23
James F. Dewey, '04
Parker F. Dunlap, '34
Russell T. Fisher, '14
Olin D. Gay, '08
Thomas Joy, '26
Harry W. Martin, '11
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Henry S. Sawyer, '32
Dean W. Symmes, '22
J. Milton Washburn, Jr., '21
A. Edwin Wells, '20

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term
(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

FIRST YEAR. SECOND TERM. (HOURS OF EXERCISE)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

SECOND YEAR. FIRST TERM

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

SECOND YEAR. SECOND TERM

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C-20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

THIRD YEAR. FIRST TERM

Electricity B–31a	30	Textile Testing G–31	30
Mill Engineering B–34a	30	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135	Worsted Yarn Manufacture G–30	225

THIRD YEAR. SECOND TERM

Knitting F–31	120	Worsted Yarn Manufacture G–30	225
Power Weaving D–32	105	Thesis.	
Woolen and Worsted Finishing H–30	75		

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds ot cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C-10	75	Physical Education	30
English E-10	45	Qualitative Analysis C-11a	45
Machine Drawing B-13	135	Textile Design and Cloth Analysis D-10	75
Mathematics B-10	60		
Mechanism B-12	60		

Second Year. First Term

Cotton Yarn Manufacture F-20a	90	Steam Engineering B-24	30
Color and Dynamic Symmetry D-33	30	Textile Chemistry and Dyeing Lect. C-20	30
Physics B-23a	45	Textile Design and Cloth Construction D-20, 21	210
Power Weaving D-24	90		

Second Year. Second Term

Cotton Yarn Manufacture F-20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G-20-21	90	Textile Design and Cloth Construction D-20, 21	135
Jacquard Design D-23	45		
Physics B-23a	45		
Power Weaving D-24	120		

Third Year. First Term

Cotton Finishing H-31	75	Textile Testing G-31	30
Cotton Yarn Manufacture F-30a	60	Woolen and Worsted Finishing H-30	75
Power Weaving D-32	60	Worsted Yarn Manufacture G-30	90
Textile Design and Cloth Construction D-30	105		

Third Year. Second Term

Cotton Finishing H-31	75	Woolen and Worsted Finishing H-30	75
Cotton Yarn Manufacture F-30a	60	Worsted Yarn Manufacture G-30	60
Jacquard Design D-31	75	Thesis.	
Power Weaving D-32	105		
Textile Design and Cloth Construction D-30	75		

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several optional subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Adv. Organic Chemistry C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–23	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Adv. Organic Chemistry C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15	Economics E–30	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
		Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90	Organic Laboratory C–36	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Options or Thesis C–52	90
Chemical Textile Testing C–43	45	Organic Laboratory C–41	75
Colloid Chemistry C–50	30	Quantitative Analysis C–46	15
Industrial Chemistry C-42	30	Report Writing C–47	15
		Technical German C–40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Organic Laboratory C–41	105
Adv. Textile Chemistry and Dyeing Lab. C–44	120	Rayon Manufacturing C–51	30
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Seminar in Business English E–40	15
Chemical Textile Testing C–43	45	Technical German C–40	30
Options or Thesis C–52	90	Technology of Wool Manufacture Fibers G-40	15
		Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has lead to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General, Design and Sales Options some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Machine Drawing B–21	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	60
Mill Engineering B–45	67	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	45
Mill Engineering B–45	30	Thesis	97

Fourth Year. Second Term

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B-21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	68	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	127

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Power Weaving D–24	105
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60	Textile Design and Cloth Construction D–20, 21	105
Physics B–23	75		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		

Third Year. Second Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	75
Cotton Yarn Manufacture F–30a	75	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D-41	90	Textile Testing B-43	60
Textile Marketing B–42	30	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Textile Design and Cloth Construction D-41	90
Cotton Finishing H–31	105	Thesis	135
Jacquard Design and Weaving D-40	105		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	105
Textile Chemistry and Dyeing Lect. C-20	30
Textile Design and Cloth Construction D–20, 21	105

Third Year. First Term

Color and Dynamic Symmetry D–33	30
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Power Weaving D–32	75
Principles of Marketing B–35	45
Textile Design and Cloth Construction D–30	105
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Color and Dynamic Symmetry D–33	30
Cotton Yarn Manufacture F–30a	75
Economics E–30	45
Marketing Methods B–36	60
Power Weaving D-32	30
Statistics	45
Textile Design and Cloth Construction D–30	75
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	90
Principles of Selling and Advertising B–49	105
Selling Policies B–52	45
Textile Design and Cloth Construction D-41	60
Textile Microscopy B–41	45
Textile Styling B–50	30
Textile Testing B–43	60
Thesis	90

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Foreign Trade and Economic Geography B–51	45
Jacquard Design and Weaving D–40	30
Knitting F–31	75
Selling Policies B–52	45
Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

LABORATORY. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.[

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:— care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B–20a. Preparation: B–10. This subject is a continuation of the work of the first-year subject B–10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B–21. Preparation: B–10, B–12, B–14. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B–23. Preparation: B–10 and B–11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B–23a. Preparation: B–10 and B–11. This subject consists of the same topics as B–23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B–24. Preparation: B–12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B–25. Preparation: B–11, B–20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B–26. Preparation: B–11 and B–12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B-30. Preparation: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B-31. Preparation: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B-31a. Preparation: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B-32. Preparation: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates. with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B–34. Preparation: B–21, B–25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B–34a. Preparation: B–21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B–34. [Courses I, II.]

Principles of Marketing—B–35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B–36. Preparation: B–35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B–40. Preparation: B–10 and E–30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B–41. Preparation: B–23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B-48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B-49. Preparation: B-36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B-50. Preparation: B-37,D-30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B-51. Preparation: E-30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B-52. Preparation: B-49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B-53. Preparations: B-20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C-10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C-11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–11. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–11a. Preparation: C–10, taken simultaneously. This course is similar to C–11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–12. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, B–12, B–14. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents,

developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C–22. Preparation: C–10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dye-

stuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C–23. Preparation: C–11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Smith's "Quantitative Chemical Analysis" is used as a text. [Course IV.]

Stoichiometry—C–24. Preparation: B–10, C–10, C–12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C–30. Preparation: C–23. The fundamental principles acquired in Course C–23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Griffin's" Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C–31. Preparation: C–22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's " Industrial Chemistry." Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–32. Preparation: C–20, C–21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Relative humidity, regain, counts and denier, twist, thickness, resilience, strength, porosity, staple, crimp, abrasion or wear.

Chemical Testing.—Qualitative tests, ash, ash alkalinity, oil and grease, soap, sizing and weighting, union analysis, baryta absorption, solubility in caustic, Methylene Blue absorption, copper number, viscosity in cuprammonia, acids and bases in textiles, damage to wool.

Optical Testing.—Spectroscope, spectrophotometer, colorimeter, tintometer, colorimetric pH apparatus, refractive index, use of ultraviolet. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C–48. Preparation: C–47. This object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C–49. Preparation: C–10, C–11, C–24, C–34, C–42, C–46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to

introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C–50. Preparation: C–33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Absorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C–51. Preparation: C–32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Optional Subjects or Thesis during fourth year—C–52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take optional work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931–32 several options were introduced, each optional period being 45 hours per term and four of these being required during the year.

If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more option periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or optional subjects, will be required for graduation.

Options: Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this option should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on absorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D-10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D-20. For Cotton Goods—Preparation: D-10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and

designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Jacquard Design—D-31. This is a continuation of Jacquard Design D-23. [Course III.]

Power Weaving—D-32. Preparation: D-20, D-21, or D-23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Color and Dynamic Symmetry—D-33. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D-40. Preparation: D-23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D-41. Preparation: D-10, D-20, D-21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E-40. Preparation: E-10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F-20. Preparation: B-10, B-12, B-14. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations

of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F-20a. Preparation: B-10, B-12, B-14. This course is similar to Course F-20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-25. Preparation: B-12, D-10. This course covers the same lectures and laboratory work as F-31. [Course VI, Option G.]

Cotton Spinning—F-30. Preparation: F-20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The

advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F–31a. Preparation: B–12, D–10. This course embraces the same lectures as Course F–31 but does not include any laboratory work. [Course VI, Options G.]

Cotton Organization—F–32. Preparation: F–20 or F–20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F–35. Preparation: F–25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F–34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F–45. Preparation: F–35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G–20. Preparation: B–10, B–12, B–13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained,

as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G–21. Preparation: B–10, B–12, B–13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W,D,S.]

Worsted Yarn Manufacture—G–30. Preparation: G–20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his

knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G-31. Preparation: B-23, F-30 or G-30, D-24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G-40. Preparation: C-21, C-32, D-10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H-30. Preparation: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali

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The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. One frame is equipped with both common and metallic drawing rolls, electric stop motions and Ermine top roll clearers. The other frame and the railway head both are equipped with metallic rolls and mechanical stop motions. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough. The last named serves to illustrate the common English construction and how it differs from the American construction as illustrated in the other roving machines.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. Four of these frames are equipped with individual motor drives,—one chain drive, one Texrope drive, one gear drive and one Washburn clutch drive. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames, and has an individual alternating current motor connected through a Reeves automatically controlled variable speed drive. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. This machine is equipped with an individual alternating current motor with a chain drive. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity. This equipment is suitable to spin coarse numbers from cotton wastes to be used in such materials as coarse sheeting, osnaburgs, twine and mop yarns.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. In addition, there is a gas conditioning oven to use in determining moisture content and regain. A number of scales and balances, together with yarn reels, roving reels and measuring boards make up the equipment for routine mill sizing tests.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B-5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company of North Andover, Mass.: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company; one mule headstock mounted on trucks for instruction purposes; one fancy yarn twister with chain and gear equipment; one filet winding drum stand with tension bars, wind, etc., for applying card clothing.

Installed by C. G. Sargent's Sons Corporation, Graniteville, Mass.: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc., of Worcester, Mass.: One 120-spindle cam mule complete; one mule headstock mounted on trucks for instruction purposes.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son, Worcester, Mass.: One card grinding stand with two traverse grinders complete.

Equipment: Modern ferrule type fiber head jack spools and bobbins by U. S. Bobbin and Shuttle Company of Lawrence; yarn baskets by Steele Supply Company, Cambridge, Mass.; hand cards by Howard Brothers of Worcester and Davis & Furber Machine Company; ring travellers by Victor Company; static suppressors by Chapman Neutralizer Company.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., Leeds, England, equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops of Biddeford, Me.; two worsted combs with baller punch, one made by Crompton & Knowles, Worcester, and the second made by James Smith & Sons, of Worcester, Mass.; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells, Keighley, England.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, Keighley, England, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works, Whitinsville, Mass. In addition to this the Saco-Lowell Shops, Biddeford, Me., have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system

through its automatic control. In this laboratory are installed six humidifiers and four Comin's High Duty heads, which are supplied from an electric-driven triplex power pump located in the power house. This same pumping equipment supplies the American Moistening Company's humidifiers operating in the Cotton Yarn Department.

French System. — For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery has been made by the Société Alsacienne de Constructions Mechaniques, Mulhouse, France, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company, Fitchburg, Mass. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company of Boston; single yarn and fabric strength-testing machines made by G. R. Smith & Company, Bradford, England; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper, Leipzig, Germany. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company of Providence, R. I., a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, also an abrasion machine for testing resistance to wear of twines, tapes, and all stripped flat fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope. For the automatic control of temperature and humidity there has been installed by the American Moistening Company, of Boston, one of its automatic humidity and temperature regulators.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company of New York.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company of Lowell. The Whitin Machine Company, Whitinsville, Mass., has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, Worcester, Mass., a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8-spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company of North Andover, Mass.

The Weaving Department contains four looms supplied by the Draper Corporation of Hopedale, Mass., which include a plain Northrup. an 8-harness cor-

duroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company of Readville, Mass., has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, Whitinsville, Mass., a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company, Lisbon Falls, Maine. The Hopedale Manufacturing Company of Milford, Mass., has recently installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 16-harness lappet loom, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company, Clinton, Mass. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons, Paterson, N. J.; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table, with ample facilities to provide distilled water through the use of a Barnstead Water Still. The Balance Room, which is adjacent to the laboratory, has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with individual benches, small dyeing apparatus, reels, balances, apparatus for dye testing, such as frames for exposing dyed material to light, and a complete collection of dyestuff samples and sample cards. There are also fifty-six steam coil experimental dyeing baths, a drying chamber and ageing chamber, in addition to a Hurricane Dryer, Class D, made by the Philadelphia Drying Machinery Company, Pennsylvania. Adjacent to the Experimental Dyeing Laboratory there has been provided a well-lighted room for the storage of a great variety of dyestuffs.

The Industrial Chemistry Laboratory contains the following: one filter press, Type E. T. Shriver & Company; a single-acting triplex plunger pump, Goulds Manufacturing Company; a vacuum drying apparatus, a surface condenser, a Packard vacuum pump, Norman Hubbard's Sons; a vacuum evaporator, Swenson system, American Foundry and Machine Company; a centrifugal, C. H. Chavant & Company; a double jar mill, F. I. Stokes & Company.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, Worcester, Mass., a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter, the Permutit Company, New York City; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine, the Textile-Finishing Machine Company, Providence, R. I.; a set of drying cans by the same concern; a chain dyeing machine, T. C. Entwistle Company, Lowell, Mass.; a raw stock drying table, Proctor & Schwartz, Philadelphia, Pa.; a padding mangle, Arlington Machine Works, Arlington, Mass.; a hydro-extractor, W. H. Tolhurst & Son, Troy, N. Y.; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. The Franklin Process Company, Providence, R. I., has furnished a 25-pound bronze dyeing machine. Of the various dye tubs, one is equipped with a Monel metal lining to withstand the action of various chemicals and dyes.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company, Orange, Mass.; a sample fulling mill, a kicker mill, furnished by James Hunter & Company, North Adams, Mass.; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company of Worcester has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson, Springfield, Vt.; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co., Woonsocket, R. I.; a tentering and drying machine furnished by John Heathcote, Providence, R. I.; a single crabbing machine, H. W. Butterworth & Son, Philadelphia, Pa.; a 72-inch woolen napper donated by Davis & Furber, North Andover, Mass.; a 32-inch basket hydro-extractor, W. H. Tolhurst, Troy, N. Y.; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company, New York; a steam press for underwear, United States Hoffman Company, Syracuse, N. Y.; a sewing machine, Birch Brothers, Somerville, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company, Worcester, Mass.; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company, Salem, Mass.; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers, Somerville, Mass.; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber, North Andover, Mass. (the ball bearings were donated by the Fafnir Bearing Company, New Britain, Conn.); an 8-inch belt lacer furnished by the Clipper Belt Lacer Company of Grand Rapids, Mich.; a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company, Boston; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system, Files Engineering Company, Inc., Bridgeport, Conn.; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company, Providence, R. I.; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company, Providence, R. I.; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company, Boston, Mass.; a trimming and overseaming machine, The Merrow Machine Company, Hartford, Conn.; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company, Philadelphia, Pa. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company, Boston, Mass.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6

Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is known as the instrument laboratory and is for the purpose of giving instruction in the measurement of current voltage, resistance, and in the calibration of instruments. It contains a 5-kilowatt Crocker-Wheeler balancer, a 160-ampere hour storage battery, a 5-kilowatt 220-volt to 440-volt General Electric transformer, a Westinghouse portable wattmeter with current and potential transformers, three wattmeters, two ammeters and a voltmeter, all of the General Electric portable alternating current type, a 30-volt alternating current Roller Smith voltmeter, a 5 to 10-scale Weston ammeter (electro-dynamometer type), a Weston millivoltmeter with 2, 20, 50 and 200 ampere shunts, three 250-volt direct current Weston voltmeters, a 150-ampere, two model 45, two model 260, Weston portable ammeters, a Weston model 260 voltmeter, a Thompson 50-ampere recording wattmeter, a General Electric rotating standard wattmeter, two General Electric induction type watt hour meters, an Esterline portable curve drawing wattmeter, a 100-ampere Leeds & Northrup Standard Resistance, a Leeds & Northrup Ayrton shunt, a Weston laboratory standard voltmeter with 600-volt multiplier, a Leeds & Northrup potentiometer, a D'Arsonval wall type galvanometer, a Wheatstone bridge with galvanometer, a slide wire bridge and electro-dynamometer, Weston Standard cell, potential phase shifter, a standard Leeds & Northrup photometer with Lummer-Brodhun screen, and Macbeth illuminometer made by the same concern.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company, Nashua, N. H.; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company, Worcester, Mass.; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works, Cincinnati, Ohio; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons, Fitchburg, Mass.; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company, Milwaukee, Wis.; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company, Nashua, N. H.; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son, Worcester, Mass.; one 14-inch single sensitive drill, from the Stanley Manufacturing Company, Lawrence, Mass.; one No. 1 Universal grinder, from Landis Tool Company, Waynesboro, Pa.; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount, Everett, Mass.; an American twist drill grinder, from the Heald Machine Company, Worcester, Mass.; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company, Cincinnati, Ohio; one 30-inch grindstone and frame, from the Athol Machine Company, Athol, Mass.; a single spindle centering machine, from D. E. Whiton Machine Company, New London, Conn.; one 15-inch shaper, from Potter & Johnson, Pawtucket, R. I.; one power hacksaw, from the Fairbanks Company, Boston, Mass.; one cold saw, from John T. Burr & Son, Brooklyn, N. Y.; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 9, 1936

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Chemistry and Textile Coloring, no thesis subjects have been listed.

Henry Steere Anthony, Jr.	Lowell, Mass.
Constantine Apostolos Basdikis	Lowell, Mass.
James Campbell deGruchy, Jr.	Stoneham, Mass.
Roland Octave Gagnon	Lowell, Mass.
George Georgacoulis	Lowell, Mass.
Moushy Markarian	Lowell, Mass.
James Reynolds Redmond	Lowell, Mass.
John James Roarke	Lowell, Mass.
Bernard James Tyler	Lowell, Mass.
Preston Sumner Valentine	Cochituate, Mass.
William Paul Welch, Jr.	Lowell, Mass.
Herbert Alvin Wormwood	Andover, Mass.

Bachelor of Textile Engineering

Wesley Elliot Bates, East Milton, Mass. "The effect of abrasion upon certain physical properties of textile fabrics."

Joseph Calvin Cobb, Dorchester, Mass. "A study of the changes in activities in the major trade associations in the textile industry."

Robert Thomas Crawford, Boston, Mass. "A comparison of color measurements obtained in the spectro-photometer and the monochromatic colorimeter."

Richard Albert Hodgman, Stoneham, Mass. "A determination of the strength relationship between single and two-ply cotton yarns." Thesis with Benjamin A. Holgate.

Arthur Newton Holden, North Billerica, Mass. "Color measurements of woven fabrics."

Benjamin Alexander Holgate, Lowell, Mass. Thesis with Richard A. Hodgman.

Wilson Gerard Ireland, Melrose, Mass. "The effect of weave upon the breaking strength and elongation of cotton fabrics." Thesis with Allan J. McQuade.

John Raymond Kaiser, Bloomfield, N. J. " An investigation of the possibility of quantitative measurements of the fashion cycle by means of retail store records."

James Harrington Kennedy, Jr., Lowell, Mass. "A study of some of the factors that alter the color and the staple length of frosted and regular wool."

Shao-Fong Lee, Shanghai, China. "A critical study of the effect of the settings of a cotton spinning frame on the variability of yarn." Thesis with Kantilal H. Shah.

Allan John McQuade, Lowell, Mass. Thesis with Wilson G. Ireland.

Emilio Gomez Moreno, Jr., Graniteville, Mass. "A study of the Walen evenness tester to determine the possibility of its use in measuring the true diameter and uniformity of two-ply cotton yarns."

Kantilal Hiralal Shah, Bombay, India. Thesis with Shao-Fong Lee.

Master of Science in Textile Chemistry

Albert Stephen Alcott, Jr., Lowell, Mass. B.T.C. 1935 Lowell Textile Institute. "Organic Qualitative Analysis."

Bertil August Ryberg, Lowell, Mass. B.T.C. 1929 Lowell Textile Institute. "The determination of wool in wool-cotton textile material."

Diploma in Cotton Manufacture

Robert Frederick Jessen, Lowell, Mass. "Twist contraction in two-ply yarns."

Diploma in Wool Manufacture

Louis Jules Dursin, Woonsocket, R. I. "The manufacture of a fancy worsted."

Raymond Bachmann Wilson, Pawtucket, R. I. "The manufacture of a fancy worsted."

Prizes awarded in June, 1936

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *Emilio Gomez Moreno, Jr.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *James Campbell de Gruchy, Jr.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Herman Timothy Buckley.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *Clinton Grossman.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Helen Jane Jarek.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Samuel Levin.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	Lowell Address
Acar, Ibrahim Zeki, VI, Istanbul, Turkey B. Sc. Tech., University of Manchester, 1936	52 Mt. Washington Street
Calder, Marian Brownson, VI, Dallas, Texas B.S., College of Industrial Arts, Texas State College for Women, 1930	137 Riverside Street
Manderbach, Harold Mills, VI, Ann Arbor, Mich. B.A., University of Michigan, 1924, Captain U.S.A.	28 Daniels Street

Under Graduate Students

Candidates for Degree

Class of 1937

Bassett, Louis Loss, VI, Lowell, Mass.	501 Andover Street
Boordetsky, Sidney Morris, VI, Cambridge, Mass.	540 Merrimack Street
Carroll, Hugh Francis, IV, Medford, Mass.	———
Daly, William James, VI, Andover, Mass.	———
Fisher, Thomas Nathan, VI, Lowell, Mass.	100 Sanders Avenue
Fuller, Roland Monroe, VI, Lowell, Mass.	R. F. D. No. 1
Hakanson, Gustave Warren, IV, Winchester, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kennedy, Robert Miller, VI, Dunstable, Mass.	———
Johnston, Lee Gale, IV, Haverhill, Mass.	———
Lincoln, Charles Ernest, IV, Mattapan, Mass.	———
Luescher, Frank Oscar, IV, Pawtucket, R. I.	65 Sterling Street
Lyle, Robert Keith, IV, Lowell, Mass.	86 Orleans Street
Megas, Charles, IV, Lowell, Mass.	114 Rock Street
Natsios, Basil Andrew, IV, Lowell, Mass.	98 Lewis Street
Nerney, Francis Xavier, IV, Lowell, Mass.	46 Dana Street
Reed, Harold Ernest, VI, Nashua, N. H.	———
Regan, Paul William, IV, Lowell, Mass.	103 Sherman Street
Robbins, Lucy Wiley, VI, Lowell, Mass.	102 South Loring Street
Spanos, James Peter, IV, Lowell, Mass.	14 West Bowers Street
Sung, Harvey Chih, VI, Tientsin, China	43 Plymouth Street
Vaniotis, Socrates Vasilios, IV, Lowell, Mass.	13 Willie Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlboro Street
Wilkinson, Herbert William, Jr., IV, Thompson, Conn.	Omicron Pi House
Wright, George Ward, Jr., IV, Newtonville, Mass.	Omicron Pi House

Class of 1938

Broadhurst, Russell Denton, IV, Middletown, Conn.	50 Standish Street
Buckley, Herman Timothy, IV, East Chelmsford, Mass.	———
Fleming, John Harvey, VI, Sanford, Me.	156 Methuen Street
Fox, Kenneth Russell, VI, Lowell, Mass.	359 Beacon Street
Freedman, David, VI, Boston, Mass.	———
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Garcia, Lorenzo Montero, VI, Mexico D. F., Mexico	156 Methuen Street
Getchell, Nelson Fletcher, IV, Lowell, Mass.	75 Pine Street
Grossman, Clinton, IV, Providence, R. I.	43 Plymouth Street
Hardy, Thomas Wadsworth, IV, Lowell, Mass.	30 Chauncey Avenue
Harpoot, Burgess Charles, VI, Lowell, Mass.	185 Liberty Street
HoLem, Charles, VI, Calgary, Alberta	19 Mt. Hope Street

Home Address	*Lowell Address*
Howard, Winfield Hersey, IV, North Chelmsford, Mass.	————
Kaplan, Samuel Gilbert, IV, Lowell, Mass.	472 Wilder Street
Kelakos, Charles George, VI, Lowell, Mass.	6 Rockdale Avenue
Kelly, Warren Thomas, VI, Lowell, Mass.	41 E Street
Klosowicz, Edward Joseph, VI, Lowell, Mass.	40 Read Street
Knight, Richard Greene Howland, Jr., VI, Fall River, Mass.	50 Standish Street
Lemieux, Robert Alphonse, IV, Lowell, Mass.	56 Third Avenue
Littlefield, Carl Richard, VI, Lowell, Mass.	69 Warwick Street
Lutz, Helmuth Erich, IV, Lowell, Mass.	7 Houghton Street
McMahon, Martin Edward, IV, Lowell, Mass.	43 London Street
Mahoney, Joseph Healey, IV, Andover, Mass.	————
Oliver, Roger Barton, VI, Lowell, Mass.	62 Glenwood Street
Olsen, Earl Edward, VI, Reading, Mass.	————
Paige, Walter Hale, Jr., VI, New Bedford, Mass.	Omicron Pi House
Ploubides, John Peter, IV, Lowell, Mass.	59 Varney Street
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Reddish, Charles Warren, IV, Cincinnati, Ohio	548 Fletcher Street
Ritchie, Newell Baird, IV, Concord, N. H.	————
Rosenstein, Leo David, VI, Baltimore, Md.	43 Plymouth Street
Shapiro, Sidney, VI, Lowell, Mass.	134 Bellevue Street
Sheehan, Leo James, IV, Dracut, Mass.	————
Sood, George David, IV, Woonsocket, R. I.	793 Merrimack Street
Stanley, Donald Edward, IV, Lowell, Mass.	706 Stevens Street

Class of 1939

Allard, Frederick Pratt, IV, Lowell, Mass.	104 Eleventh Street
Baker, Phyllis Jeanne, VI, Concord, Mass.	Dalton Road, Chelmsford
Banta, John Garret, VI, Grantwood, N. J.	Phi Psi House
Beauregard, Albert Joseph, VI, Lowell, Mass.	258 Varnum Avenue
Bone, Arthur P. Stuart, VI, Hollywood, Calif.	Phi Psi House
Brantman, Jackson Agmor, VI, New York, N. Y.	Phi Psi House
Colby, Vernon Warren, IV, Haverhill, Mass.	————
Comins, Richard Coolidge, VI, Ballardvale, Mass.	————
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Cutrumbes, Demosthenes John, IV, Dracut, Mass.	————
Depoian, Vasken John, IV, Lowell, Mass.	8 Gates Street
Dick, Henry Kendal, VI, Bloomfield, N. J.	65 Sterling Street
Dori, Anita Marie, VI, Chester, Mass.	137 Riverside Street
Ekstrand, Frederic Lawrence, VI, Stafford Springs, Conn.	20 Summit Ave., Lawrence
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Gianaris, George Demetrios, VI, Lowell, Mass.	678 Lakeview Avenue
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Greene, John Lester, VI, Lowell, Mass.	388 East Merrimack Street
Jarek, Helen Jane, IV, Lowell, Mass.	74 Eleventh Street
Kareores, Gregory George, VI, Lowell, Mass.	52 Lewis Street
Kiernan, James Vincent, VI, Dracut, Mass.	————
LaBonte, Andrew Shea, VI, Lawrence, Mass.	————
Lambert, Robert DeForest, VI, Tyngsborough, Mass.	————
Levin, Samuel, IV, Lowell, Mass.	43 Ware Street
Lyons, James Francis, Jr., IV, Nashua, N. H.	————
Marsden, Sidney Robert, IV, Methuen, Mass.	————
Miller, Arnold Irving, Lowell, Mass.	268 Shaw Street
Monahan, Harold Joseph, IV, Dorchester, Mass.	————
Murphy, Hubert James, IV, Lowell, Mass.	999 Princeton Street

Home Address	*HLowell Address*
O'Donoghue, Eileen Margaret, VI, Lowell, Mass.	20 Columbia Street
Olsen, Herbert Charles, IV, Reading, Mass.	———
Page, Herbert Stanton, IV, Chelmsford, Mass.	———
Patsourakos, James Peter, IV, Lowell, Mass.	619 Market Street
Prescott, William Benjamin, IV, Westford, Mass.	———
Reddish, Thomas Warren, IV, Cincinnati, Ohio	548 Fletcher Street
Reed, Everett Carlton, VI, Chelmsford, Mass.	———
Reed, William Thorncroft, VI, Lowell, Mass.	617 Westford Street
Rowntree, Clyde Burton, IV, Lowell, Mass.	134 Liberty Street
Spevack, Edward, IV, Carlstadt, N. J.	43 Plymouth Street
Steinberg, Sidney, VI, Brooklyn, N. Y.	9 White Street
Thomas, Fred, VI, Holden, Mass.	Omicron Pi House
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Tuttle, Kendall Chapin, VI, Groton, Mass.	———
Winkler, Burton Cole, IV, Elizabeth, N. J.	Phi Psi House

Class of 1940

Aigen, Lawrence, VI, Brooklyn, N. Y.	142 Riverside Street
Balas, Fred Frank, VI, Lowell, Mass.	196 Mt. Pleasant Street
Beltramini, Kenneth Charles, VI, West Englewood, N. J.	43 Plymouth Street
Bodfish, Sumner Porter, VI, Concord, Mass.	———
Brooks, Raymond King, VI, Unionville, Conn.	11 White Street
Bullock, Merlen Clarke, VI, Lowell, Mass.	38 Burtt Street
Campbell, Andrew Morris, IV, Lawrence, Mass.	———
Chapman, Boyd Palmer, Jr., VI, Franklin, Mass.	137 Riverside Street
Chisholm, Kenneth, Jr., IV, Medford, Mass.	———
Connors, Arthur Aloysius, VI, Lowell, Mass.	25 Twelfth Street
Crocker, Morris Redmond, IV, Westford, Mass.	———
Currier, Arthur Melvin, VI, Montclair, N. J.	137 Riverside Street
Damon, Winslow Pickard, VI, West Concord, Mass.	53 Mt. Hope Street
Davis, Arthur Sabin, IV, Lowell, Mass.	105 Inland Street
Davison, John Reb, VI, Ashaway, R. I.	159 White Street
Devine, Aubrey Pershing, IV, Lowell, Mass.	27 Parkview Avenue
Dupras, Francis Lorain, IV, Lowell, Mass.	101 Warwick Street
Esielionis, Victor John, VI, Shirley, Mass.	———
Falk, Stanley, VI, Brooklyn, N. Y.	123 Riverside Street
Feuerstein, James Mayer, VI, Jamaica Plain, Mass.	84 Gates Street
Finn, Joseph Francis, IV, Milton, Mass.	75 Fourth Avenue
Fox, Louise, VI, Dracut, Mass.	———
Gill, John Schofield, IV, Andover, Mass.	———
Grothe, David Ivan, VI, Laconia, N. H.	148 Riverside Street
Haas, Alexander Robert, VI, Brooklyn, N. Y.	43 Plymouth Street
Hall, Richard Thomas, IV, Lowell, Mass.	54 Seventh Street
Hull, Robert Barney, VI, Lowell, Mass.	606 Stevens Street
Hurwitz, Milton, VI, Brooklyn, N. Y.	226 Riverside Street
Jones, Newton Adelbert, IV, Melrose, Mass.	———
Jones, Wilbur Ward, VI, New Rochelle, N. Y.	63 Varnum Avenue
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Kennedy, John Francis, VI, Lowell, Mass.	20 Bertha Street
Lanner, Arthur William, IV, Lowell, Mass.	Box 1, Route 1
Lynch, Edward Mark, IV, Lawrence, Mass.	———
McCord, Robert Maxwell, VI, Westerly, R. I.	71 Canton Street
McGilly, John Seede, VI, Lowell, Mass.	16 Talbot Street
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
Manning, Neil Joseph, VI, Lowell, Mass.	118 Mt. Washington Street
Markham, Edward Francis, IV, Ayer, Mass.	———
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street

Home Address	*Lowell Address*
Meuser, Rudolph Walter, VI, Pawtucket, R. I.	137 Riverside Street
Mickolus, Edward Francis, IV, Lawrence, Mass.	———
Nelson, William Arthur, IV, Lowell, Mass.	896 Westford Street
Nuttall, Andrew Frederick, IV, North Billerica, Mass.	———
O'Donoghue, John Kew, VI, Lowell, Mass.	84 Florence Avenue
Pelt, Joseph, Jr., VI, South Orange, N. J.	142 Riverside Street
Pero, Henry Leland, VI, West Willington, Conn.	11 White Street
Read, Clinton Jay, IV, Westport Point, Mass.	Phi Psi House
Reed, George Blake, VI, Lowell, Mass.	617 Westford Street
Roth, Paul, VI, Brooklyn, N. Y.	142 Riverside Street
Roux, Frank George, IV, New York, N. Y.	43 Plymouth Street
Rovner, Albert Hyman, VI, Chelsea, Mass.	37 Varney Street
Sakelaris, Dionysius John, IV, Lowell, Mass.	78 Varney Street
Shuster, Nathan George, IV, Lowell, Mass.	47 Washington Street
Silverman, Joseph Melvin, VI, Winthrop, Mass.	268 Shaw Street
Storey, Victor Wilson, IV, Dracut, Mass.	———
Sweatt, Safford Pershing, IV, Lowell, Mass.	124 Stevens Street
Taylor, Roy Arnold, Jr., IV, West Newton, Mass.	———
Teague, Edward Joseph, VI, Lowell, Mass.	43 Carter Street
Thayer, Walter Stephen, VI, New Ipswich, N. H.	156 Methuen Street
Upton, George Joseph, IV, Fitchburg, Mass.	———
Wheelock, Silas Mandeville, Jr., VI, Putnam, Conn.	53 Mt. Hope Street
Wilkinson, Freeman Firth, IV, Thompson, Conn.	Omicron Pi House
Woodard, Malcolm Russell, IV, Chelmsford, Mass.	———
Wolf, Irving Jacob, VI, Lowell, Mass.	218 Gibson Street
Zarules, George ,IV, Peabody, Mass.	413 Adams Street

Diploma Students

Class of 1937

Gay, Leon Stearns, Jr., II, Lowell, Mass.	515 Varnum Avenue
Pease, Kilburn Gray, I, Lowell, Mass.	156 Methuen Street

Class of 1938

Foss, George Woodrow, II, Haverhill, Mass.	Phi Psi House
Grinnell, King Asa, II, Fall River, Mass.	Phi Psi House
Kane, Roger Hugh, II, Cherry Valley, Mass.	75 Fourth Avenue
Lehto, Reino Gust, III, Maynard, Mass.	———

Class of 1939

Agan, William Wallace, II, Ludlow, Vt.	123 Riverside Street
Argersinger, Clarence Daniel, II, Fort Johnson, N. Y.	Omicron Pi House
Bauer, Frank Norbert, I, Waterloo, Ont.	226 Riverside Street
Campbell, James Joseph, Jr., II, Billerica, Mass.	———
Cohen, Leonard Lee, II, Rochester, N. Y.	14 Mt. Washington Street
Finn, Charles Anthony, II, Milton, Mass.	75 Fourth Avenue
Gay, Clarence Russel, III, Lebanon, N. H.	140 Methuen Street
Goldstein, Seymour, II, New York, N. Y.	100 Riverside Street
Hackett, John James, II, Groton, Mass.	———
Hockmeyer, Clive Edward, Jr., I, Lowell, Mass.	7 Whitman Street
Janos, John Edward, II, Brookline, Mass.	———
Kaplan, B. David, II, New York, N. Y.	148 Riverside Street
Little, Ralph Harding, II, Rockville, Conn.	32 Mt. Washington Street
Merritt, Charles Adelbert, II, Rockland, Me.	137 Riverside Street
Miller, Everett Ellsworth, III, Westford, Mass.	———
Moulton, Ralph Herbert, II, Madison, Me.	43 Plymouth Street

Home Address	*Lowell Address*
Rees, Richard Holmes, II, Townsend Harbor, Mass.	———
Reid, Raymond Whitney, III, Lowell, Mass.	87 Bellevue Street
Schaake, Ralph Roland, III, Methuen, Mass.	———
Scribner, James Woodbury, II, Manchester, N. H.	37 Varney Street
White, Robert Gordon, II, Worcester, Mass.	63 Varnum Avenue
Wiesner, Arthur Charles, II, Lawrence, Mass.	———
Zehntbauer, John Alfred, I, Portland, Ore.	11 Royalston Avenue

Special Students

Allaire, Alexander Hector, IV, Woonsocket, R. I.	793 Merrimack Street
Churchill, Harry Coburn, IV, Lowell, Mass.	214 Third Street
Clarke, John Thomas, VI, Chelmsford, Mass.	———
Croteau, George Ernest, III, Lowell, Mass.	88 Chelmsford Street
Doukszewicz, Joseph Francis, III, Lowell, Mass.	52 Whipple Street
Finn, George Raphael, B.A., II, Milton, Mass.	75 Fourth Avenue
Haesebrouck, Lucien Henry, VI, Lowell, Mass.	67 Worthen Street
Hsu, Ming Shou, B.S., I, Nauzin, Chekiang, China	53 Mt. Hope Street
Jokinen, Lauri Eugene, III, Stow, Mass.	———
Jokinen, Wilber Henry, III, Maynard, Mass.	———
Lillis, Marvin Hale, IV, Lawrence, Mass.	Y. M. C. A.
McCusker, Thomas Bernard, Jr., III, East Braintree, Mass.	———
Mandycz, Aleck, III, Methuen, Mass.	———
Mann, Billings Leland, II, Fall River, Mass.	Phi Psi House
Miller, Joseph Smith, VI, Salt Lake City, Utah	479 Westford Street
Pimstein, Abraham Wainer, III, Santiago, Chili	Y. M. C. A.
Webster, Everard Pomeroy, B.A., VI, Bennington, Vt.	10 Meadowcroft Street
Wessells, Joseph Francis, IV, Lowell, Mass.	31 England Street
Zehntbauer, Ruth Aileen, VI, Portland Oregon	11 Royalston Avenue

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1937. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville Mass.

Abbott, George Richard, II, '08 (D). Andover, Mass.

Adams, Floyd Willington, VI, '16 (B.T.E.).

Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.

Adams, Tracy Addison, IV, '11 (D). Vice-President, Arnold Print Works, North Adams, Mass.

Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.

Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.), '36 (M.S.). Chemist and Dyer, Franklin Rayon Corporation, Providence, R. I.

Allard, Edward Joseph, IV, '31 (B.T.C.). Chemist, National Aniline & Chemical Company, Boston, Mass.

Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.

Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.

Anderson, Arthur Illman, IV, '24 (B.T.C.). Associate, Department of Research, Laundryowners National Association, Joliet, Ill.

Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York Ci y.

Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.

Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Lowell, Mass.

Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.

Anthony, Henry Steere, Jr., IV, '36 (B.T.C.). 20 Loring Street, Lowell, Mass.

Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.

Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.

Arundale, Henry Barnes, II, '07 (D). Textile Technician, for G. H. Heath & Co., Ltd., Macclesfield, England, Malden, Mass.

Atwood, Henry Jones, II, '23 (D). Superintendent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II '31 (D). With Knox Woolen Company, Camden, Maine.

Babigan, Edward, IV, '33 (B.T.C.). 121 Bellevue Street, Lowell, Mass.

Babigan, Raymond, IV, '24 (B.T C.). Associate Examiner, United States Patent Office, Washington, D. C.

Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.

Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.) Time Study, Worsted Division, Pacific Mills, Lawrence, Mass.

Bailey, Joseph W., I, '09 (D). Agent, Booth Manufacturing Company, New Bedford, Mass.

Bailey, Lester Harold, IV, '24 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.

Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.

Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.

Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.

Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). Vice-President and Secretary, Walter Blue & Co., Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B T.C.). President, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin, I, '00 (D). Second Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.

Basdikis, Charles Apostolos, IV, '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.

Bates, Wesley Elliot, VI, '36 (B.T.E.). Engineering Department, Scott & Williams, Inc., Laconia, N. H.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beattie, John Silas, IV, '35 (B.T.C.). Chemist, United States Testing Company, Hoboken, N. J.

Beck, Frederic Christian, II, '24 (D.). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). Textile Engineer, Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). Sales and Service, Calgon, Inc., Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlan ic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporaion of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler and Designer, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Designer, Atlanta Woolen Mills, Atlanta, Ga.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Assistant Chief Chemist, Armour Soap Works, North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.

Blake, Parker Gould, VI, '14 (D). Sales Manager, Slingsby Silks, Ltd., Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). Assistant Selling Agent, Ludlow Manufacturing and Sales Company, 211 Congress Street, Boston, Mass.

Bogdan, John Francis, VI, '35 (B.T.E.). Second Hand, Cotton Winding Department, Manville Jenckes Corporation, Manville, R. I.

Booth, James Mooney, IV, '24 (B.T.C.). Salesman, The Huron Milling Company, 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Designer, Joshua L. Bailey & Co., 10-12 Thomas Street, New York City.

Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.

Brackett, Martin Richard, II, '22 (D.). Selling Agent, 450 7th Avenue, New York City.

Bradford, Edward Hosmer, VI, '35 (B.T.E.). Research, Carding Department, Manville-Jenckes Corporation, Manville, R. I.

Bradford, Harold Palmer, II, '25 (D). 90 Beach Street, Malden, Mass.

Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.

Bradford, William Swanton, VI, '31 (B.T.E.). Assistant Superintendent, Dress Goods Division, Lawrence Manufacturing Company, Lowell, Mass.

Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.

Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.

Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.

Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.

Brandt, Carl Dewey, VI, '20 (B.T.E.). In charge Cotton Spinning Research, Whitin Machine Works, Whitinsville, Mass.

Brannen, Leon Vincent, III, '07 (C).

Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.

Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.

Bridges, Herbert Gardner, II, '34 (D). Assistant to Superintendent, Sanford Mills, Sanford, Me.

Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears & Co., 65 Worth Street, New York City.

Bronson Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.

Brosnan, William Francis, IV, '27 (B.T.C.). Overseer of Dyeing, Bradford Dyeing Association, Bradford, R. I.

Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.

Brown, Philip Franklin, II, '23 (D). Assistant Director of Sales, DuPont Rayon Company, 350 Fifth Avenue, New York City.

Brown, Rollins Goldthwaite, IV, '12 (D).

Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.

Brown, Will George, Jr., IV, '22 (B.T.C.). Chemist, American Hide & Leather Company, Lowell, Mass.

Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.

Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.

Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.

Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.

Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.

Burke, James Edward, Jr., IV, '34 (B.T.C.). With Newmarket Manufacturing Company, Lowell, Mass.

Burnham, Frank Erwin, IV, '02 (D . Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.

Burns, Robert, IV, '28 (B.T C.).

Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.

Buzzell, Harry Saville, VI, '29 (B.T.E.). Color Technician, Oxford Paper Company, Rumford, Maine.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.

Campbell, Alexander, VI, '23 (B.T.E.). Assistant Chief Engineer, Quincy Market Cold Storage & Warehouse Company, Boston, Mass.

Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell C ., South Boston, Mass.

Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.

Campbell, Orison Sargent, II, '03 (D). Manager, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B.T.C.). Chemist, Sandoz Chemical Works, 63 Oliver Street, Boston, Mass.

Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Coach Lace Company, Bridgeport, Conn.

Carr, George Everett, I, '05 (D). Industrial Engineer, C. F. Mueller Company, 180 Baldwin Avenue, Jersey City, N. J.

Carr, Paul Edward, II, '24 (D). Designer, Cascade Woolen Mills, Oakland, Me.

Carter, Robert Albion, IV, '02 (D). District Manager, DuPont Dyestuffs E. I. du Pont de Nemours & Co., Birdsboro, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). Dyer, Bradford Dyeing Association, Bradford, R. I.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). Manager, Barbour Mills, Montello, Mass.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.).

Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.

Church, Charles Royal, II, '06 (C). Teacher and Athletic Coach, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clark, Earl William, IV, '18 (B.T.C.). Salem Depot, N. H.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). Dyer, Seamans & Cobb Thread Mills, Hopkinton, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mill, Lowell, Mass.
Cleary, Charles Joseph, II, '13 (D.) Textile Technologist, United States Army Air Corps, Dayton, Ohio.
Clement, David Scott, IV, '24 (B.T.C.). Chemist, Nashua Manufacturing Company, Nashua, N. H.
Cleveland, Richard Sumner, VI, '30 (B.T.E.). Assistant Textile Technologist, National Bureau of Standards, Washington, D. C.
Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.
Clogston, Raymond B., IV, '04 (D). Dyer, Merrimack Manufacturing Company, Lowell, Mass.
Cluett, John Girvin, I, '29 (D). Foreman of Examining at Bleachery, Cluett, Peabody & Co., Inc., Waterford, N. Y.
Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.
Cobb, Joseph Calvin, VI, '36 (B.T.E.). With Thermoid, Trenton, N. J.
Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.
Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.
Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.
Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3006, New York City.
Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Assistant Superintendent, Hohokus Bleachery, Hohokus, N. J.
Cole, Edward Earle, IV, '06 (D).
Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.
Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.
Conant, Harold Wright, I, '09 (D). Assistant Treasurer, United Elastic Corporation, Easthampton, Mass.
Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears & Co., 65 Worth Street, New York City.
Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.
Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.
Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.
Connorton, John Joseph, Jr., III, '27 (D). Designer, Pacific Mills, Lawrence, Mass.
Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.
Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.
Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.
Cowan, Raymond Bernard, IV, '35 (B.T.C.).
Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.
Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.
Crane, Eugene Francis, II, '33 (D). 517 Westford Street, Lowell, Mass.
Crawford, Robert Thomas, VI, '36 (B.T.E.). Textile Analyst, Limerick Yarn Mills, Inc., Limerick, Me.
Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.
Crowe, Joseph Bailey, IV, '25 (B.T.C.). Textile Chemist, Procter & Gamble Co., Ivorydale, Ohio.
Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.

Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, Ralph E. Loper & Co., Greenville, S. C.

Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.

Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.

Currier, John Alva, II, '01 (D). Superintendent of Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.

Curtin, William John, IV, '35 (B.T.C.). Insurance Agent, John Hancock Mutual Life Insurance Company, Lowell, Mass.

Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.

Curtis, William Leavitt, II, '05 (C).

Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

Cuttle, James H., II, '99 (D). Vice-President and General Manager, S. Stroock & Co., Inc., Newburgh, N. Y.

Daley, Charles Lincoln, IV, '34 (B.T.C.). 239 Stevens Street, Lowell, Mass.

Dalton, Gregory Smith, IV, '12 (D).

Danahy, Arthur Joseph, IV, '31 (B.T.C.). Chemist, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.

Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.

Datar, Anant Vithal, VI, '24 (B.T.E.). Manager, The Chalisgaon Shri Laxmi Narayan Mills Co., Ltd., Chalisgaon, E.K., India.

Davidson, Sydney, III, '28 (D)

Davieau, Alfred Edward, VI, '16 (D). Chief of Textile Section, United States Testing Company, 1415 Park Avenue, Hoboken, N. J.

Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd. (F. C. Huyck & Sons), Arnprior, Ont.

Davieau, Leon Arthur, VI, '23 (B.T.E.). Textile Engineer, United States Rubber Products, Inc., Market and South Streets, Passaic, N. J.

Davis, Alexander Duncan, VI, '14 (B.T.E.). Instructor, Northeastern University, Springfield, Mass

Dearborn, Roy S., VI, '13 (D). With Real Estate Department, Andover Savings Bank, Andover, Mass.

Dearth, Elmer Elbridge, IV, '12 (D). Factory Manager, Mansfield Tire & Rubber Co., Mansfield, Ohio.

deGruchy, James Campbell, Jr., IV, '36 (B.T.C.). With Lever Brothers, Cambridge, Mass.

Del Plaine, Parker Haywood, IV, '25 (B.T.C.). Southern Manager, Rohm & Hass Company, Inc., 1109 Independent Building, Charlotte, N. C.

Dempsey, Phillip Edward, IV, '33 (B.T.C.). Chemist, American Aniline Products, Inc., Boston, Mass.

Derby, Roland Everett, IV, '22 (B.T.C.). Chemist, M. T. Stevens & Sons Company, North Andover, Mass.

de Sa, Francisco, VI. '18 (B.T.E.). Avenue da Graca, Bahia, Brazil.

Dewey, James French, II, '04 (D). President and Treasurer, A. G. Dewey Company, Quechee, Vt.

Dewey, Maurice William, II, '11 (D). National Life Insurance Company, Montpelier, Vt.

Dillon, James Henry, III, '05 (D).

Dion, Ernest Lorenzo, IV, '35 (B.T.C.). With Pacific Mills, Worsted Division, Lawrence, Mass.

Dods, James Barber, II, '27 (D). Vice-President and General Manager, The Dods Knitting Company, Ltd., Orangeville, Ont.

Dolan, William Francis, IV, '28 (B.T.C.).

Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.

Donohoe, Edward Joseph, VI, '34 (B.T.E.). Textile Engineer, United States Testing Company, Inc., Hoboken, N. J.
Donovan, Joseph Richard, IV, '24 (B.T.C.). 81 Strathmore Road, Brookline, Mass.
Doran, Wilbur Kirkland, II, '22 (D).
Dorr, Clinton Lamont, VI, '14 (D). General Manager, Raymond's, Inc., 356 Washington Street, Boston, Mass.
Douglas, Walter Shelton, II, '21 (D). Estimator, Douglas & Co., Lowell, Mass.
Dudley, Albert Richard, VI, '31 (B. T. C.). With Chicopee Manufacturing Corporation, Manchester, N. H.
Duggan, Paul Curran, IV, '31 (B.T.C.). Chemist, Gotham Silk Hosiery Company, 580 First Avenue, New York City.
Duguid, Harry Wyatt, I, '24 (D). Assistant Superintendent, Maverick Mills, East Boston, Mass.
Dunlap, Kirke Harold, Jr., VI, '30 (B.T.E.). Textile Engineer, Kenwood Mills, Ltd., Arnprior, Ont.
Dunlap, Parker Frank, VI, '34 (B. T. E.). With Chicopee Manufacturing Corporation, Chicopee Falls, Mass.
Dunnican, Edward Tunis, VI, '24 (B.T.E.). Instructor in Textile Work, Passaic Public Schools, Passaic, N. J.
Durgin, William Ernest, IV, '24 (B.T.C.). Textile Chemist and Colorist, Geigy Company, Inc., 88 Broad Street, Boston, Mass.
Dursin, Louis Jules, II, '36 (D). Student in France.
Duval, Joseph Edward, II, '10 (D). Sales Manager, Massachusetts Mohair Plush Company, 3701 North Broad Street, Philadelphia, Pa.
Dwight, John Francis, Jr., II, '08 (D). Hazel Avenue, Scituate, Mass.

Echavarria, Luis, VI, '35 (B.T.E.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia.
Echecopar, Jesus Fortunato, VI, '33 (B.T.E.). Director-Gerente, Sociedad Agricola Tejada Ltda., Lima, Peru.
Echmalian, John Gregory, VI, '16 (B.T.E.). Director, State Trade School, Manchester, Conn.
Ehrenfried, Jacob Benjamin, II, '07 (C). Manager, George Ehrenfried Company, Lewiston, Maine.
Eismann, Edmund, IV, '35 (B.T.C.). With Manville-Jenckes Manufacturing Company, Pawtucket, R. I.
Elliott, Gordon Baylies, II, '12 (D). Planning Department, Pacific Mills, Lawrence, Mass.
Ellis, Charles Albert, VI, '21 (B.T.E.). 901 Danforth Street, Syracuse, N. Y.
Ellis, Dorothy Myrta, VI, '25 (B.T.E.). Department of Agriculture, Washington, D. C.
Ellis, James Oliver, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Uncasville, Conn.
Engstrom, Karl Emil, VI, '12 (D). (S.B. 1916, Massachusetts Institute of Technology.) 36 Fairfield Street, Boston, Mass.
Enloe, Winfred Paige, I, '22 (D). Agent, The W. A. Handley Manufacturing Company, Roanoke, Ala.
Evans, Alfred Whitney, III, '03 (D).
Evans, Paul Richard, II, '29 (D). 20 Lawton Avenue, Grantwood, N. J.
Evans, William Robinson, III, '03 (D). 309 Main Street, Bradford, Mass.
Everett, Charles Arthur, IV, '19 (B.T.C.). Instructor, Dyeing Department, Lowell Textile Institute, Lowell, Mass.

Fairbanks, Almonte Harrison, II, '09 (D). President and General Manager, Fairwood Knitting Mills, Wakefield, Mass.
Fairbanks, Evan Hobbs, VI, '35 (B. T. E.). Production Manager, Western Franklin Process Co., 2650 Coyne St., Chicago, Ill.
Farkas, Zoltan Roland, IV, '35 (B.T.C.). Assistant Chemist, Providence Dyeing, Bleaching and Calendering Co., Providence, R. I.

Farley, Clifford Albert, VI, '28 (B.T.E.). Research Laboratory, F. C. Huyck & Sons, Albany, N. Y.

Farmer, Chester Jefferson, IV, '07 (D). (Ph.D. Harvard University.) Professor of Chemistry, Northwestern University Medical School, Chicago, Ill.

Farnsworth, Harold Vincent, VI, '16 (B.T.E.). Textile Engineer, Atkinson, Haserick & Co., 152 Congress Street, Boston, Mass.

Farr, Leonard Schaefar, II, '08 (D). Superintendent, No. 2 Mill, Farr Alpaca Company, Holyoke, Mass.

Farwell, Claude Chapman, VI, '23 (B.T.E.). Groton, Mass.

Fasig, Paul Leon, IV, '28 (B.T.C.). Salesman, Investment Trust, Wellington Foundation, Philadelphia, Pa.

Feinberg, Benjamin, II, '27 (D). With Copley Realty Company, Boston, Mass.

Feindel, George Paul, IV, '24 (B.T.C.). Chemist, Union Bleachery, Greenville, S. C.

Feldstein, Martin Alexander, VI, '24 (B.T.E.). Radio Engineer, Amplex Instrument Laboratories, New York City.

Fels, August Benedict, II, '99 (D). 190 Carroll Street, Paterson, N. J.

Ferguson, Thomas Dickson, VI, '32 (B.T.E.). With Gilbert Knitting Company, Little Falls, N. Y.

Ferguson, William Gladstone, III, '09 (D). Assistant Agent, Ludlow Manufacturing Associates, Ludlow, Mass.

Ferris, Arthur Leon, II, '28 (D). Port Rowan, Ont.

Finlay, Harry Francis, IV, '10 (D). Chemist and Salesman, National Aniline and Chemical Company, Boston, Mass.

Fisher, Russell Todd, VI, '14 (D). '25 (B.T.E.). Secretary, National Association of Cotton Manufacturers, 80 Federal Street, Boston, Mass.

Fiske, Starr Hollinger, II, '09 (D). 119 Livingston Avenue, Lowell, Mass.

Fitzgerald, John Francis, IV, '18 (B.T.C.). Manager, Fitgerald's, Cleansers & Dyers, Winchester, Mass.

Fitzgerald, John Francis, IV, '28 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.

Fleischmann, Meyer, IV, '20 (B.T.C.). Chief Chemist, Real Silk Hosiery Mills, Inc., Indianapolis, Ind.

Fleming, Frank Everett, IV, '06 (D). Superintendent, Dyeing and Finishing, Goodall Worsted Company, Sanford, Maine.

Fletcher, Howard Varnum, III, '25 (D).

Fletcher, Roland Hartwell, VI, '10 (D). Engineering Department, Pressed Steel Car Company, Pittsburgh, Pa.

Flood, Thomas Henry, IV, '27 (B.T.C.). Chemist, National Aniline & Chemical Company, Toronto, Ont.

Flynn, Thomas Patrick, IV, '11 (D).

Ford, Edgar Robinson, IV, '11 (D). Technical Superintendent, Sayles Biltmore Bleacheries, Biltmore, N. C.

Ford, Stephen Kenneth, IV, '28 (B.T.C.). Chemist, Marden-Wild Corporation, Somerville, Mass.

Forsaith, Charles Henry, VI, '20 (B.T.E.). Superintendent, Nashua Manufacturing Company (Jackson Mills), Nashua, N. H.

Forsaith, Ralph Allen, VI, '16 (B.T.E.). In charge of Textile Section, Anderson-Meyer Company, Ltd., Shanghai, China.

Forsyth, Harold Downes, VI, '23 (B.T.E.). Treasurer, Wm. Forsyth & Sons Company, Lynn, Mass.

Forsythe, George, VI, '34 (B.T.E.). With the Chicopee Manufacturing Corporation, Chicopee Falls, Mass.

Foster, Boutwell Hyde, VI, '17 (B.T.E.). Manager, Textile Section, United States Rubber Products, Inc., Passaic, N. J.

Foster, Clifford Eastman, II, '01 (D). Overseer, National Silk Spinning Company, New Bedford, Mass.

Fowle, Edwin Daniels, VI, '24 (B.T.E.). Associate Editor, "Textile World," 330 West 42nd Street, New York City.

Fox, David James, VI, '34 (B.T.E.). With Horner Brothers Woolen Mills, Eaton Rapids, Mich.

Franks, Jerome, VI, '27 (B.T.E.). (M.S. 1929, Massachusetts Institute of Technology.) 44 Midwood Street, Brooklyn, N. Y.
Frederickson, Charles Joseph, Jr., IV, '29 (B.T.C.). Chemist, White & Hodges, Everett, Mass.
French, Wallace Howe, IV, '31 (B.T.C.). Overseer of Dyeing, Atlas Underwear Company, Richmond, Ind.
Frost, Harold Benjamin, II, '12 (D). Resident Manager, Liberty Mutual Insurance Company, Brockton, Mass.
Fuller, Allen Reed, IV, '17 (B.T.C.). Textile Chemist, A. E. Staley Manufacturing Company, Decatur, Ill.
Fuller, George, I, '03 (D). Consulting Textile Expert, Cox and Fuller, 320 Broadway, New York City.
Gagnon, Roland Joseph Octave, IV, '36 (B.T.C.). 7 Hillcrest Circle, Nashua, N. H.
Gahm, George Leonhard, II, '06 (D). Superintendent, Wood Worsted Mills, Lawrence, Mass.
Gainey, Francis William, IV, '11 (D). Colorist, National Aniline & Chemical Co., Buffalo, N. Y.
Gale, Harry Laburton, III, '10 (D). With J. P. Stevens Company, 44 Leonard Street, New York City.
Gallagher, Arthur Francis, IV, '30 (B.T.C.). Overseer of Dyeing, Hillsborough Mills, Wilton, N. H.
Gallagher, John Waters, II, '27 (D). Groveland Hotel, Danbury, Conn.
Garlick, Mrs. Dorothy M. (Burbeck, Dorothy M.), IV, '20 (B.T.C.). 192 Great Road, Maynard, Mass.
Garner, Allen Frank, II, '30 (D). Assistant Manager, Kezar Falls Woolen Company, Kezar Falls, Me.
Gaudet, Walter Urban, II, '29 (D). Resident Engineer, Liberty Mutual Insurance Company, Charlotte, N. C.
Gay, Olin Dow, II, '08 (D). President, Gay Brothers Company, Cavendish, Vt.
Georgacoulis, George, IV, '36 (B.T.C.). With Jersey Testing Laboratories, Newark, N. J.
Gerrish, Walter, III, '03 (D).
Gifford, Alden Ives, Jr., VI, '34 (B. T. E.). Research Engineer, Pepperell Mfg. Co., Biddeford, Me.
Gillespie, Francis Clifford, IV, '34 (B.T.C.). Dyeing Department, Pacific Print Works, Lawrence, Mass.
Gillie, Stanley James, I, '22 (D). Manager, United States Testing Company, Inc., 255 North Greene Street, Greensboro, N. C.
Gillon, Sara Agnes, IIIb, '06 (C).
Gilman, Ernest Dana, II, '26 (D). Designer, Pacific Mills, Worsted Division, Lawrence, Mass.
Gleklen, Leo, IV, '32 (B.T.C.). Boss Dyer, Hope Knitting Company, Pawtucket, R. I.
Glickman, Bernhardt Brecher, IV, '27 (B T.C.). (B.S. 1931, Columbia University.)
Glowacki, Joseph, VI, '32 (B.T.E.). 105 Salem Street, Andover, Mass.
Glowienski, Mitchell, IV, '34 (B.T.C.).
Godfrey, Harold Thomas, VI, '26 (B.T.E.). Director and Salesman, Davis & Furber Machine Co., North Andover, Mass.
Goldberg, George, VI, '10 (D). Salesman, Liberty Lace and Braid Company, 88 Bedford St., Boston, Mass.
Goldenburg, Louis G., VI, '27 (B.T.E.). Foreman of Knitting, Raynit Mills, Brooklyn, N. Y.
Goldman, Moses Hyman, IV, '20 (B.T.C.). Manufacturer of Chemical Specialties, Moleo Products Company, 210 Broadway, Everett, Mass.
Golec, Edward Lucian, III, '32 (D). Designer, Manhattan Shirt Company, New York City.
Goller, Harold Poehlmann, II, '23 (D). Salesman, Seydel Chemical Company, Greenville, S. C.
Goodhue, Amy Helen, IIIb, '00 (C). See Harrison, Mrs. Arthur.

Gooding, Francis Earle, IV, '19 (B.T.C.). Superintendent, Calco Chemical Company, Bound Brook, N. J.

Goosetrey, Arthur, IV, '21 (B.T.C.). With French Worsted Company, Woonsocket, R. I.

Goosetrey, John Thomas, IV, '21 (B.T.C.). Overseer of Dyeing, New York Mills Corporation, New York Mills, N. Y.

Gottschalck, Lawrence William, VI, '28 (B.T.E.). Sales Office, Scott & Williams, Inc., 366 Broadway, New York City.

Gould, Norman Culver, VI, '19 (B.T.E.). Textile Designer, F. C. Huyck & Sons, Albany, N. Y.

Graham, Robert Theodore, IV, '34 (B.T.C.). Sales Service Section, DuPont Rayon Company of New York at the Aberfoyle Manufacturing Company, Chester, Pa.

Greenbaum, Herbert Baron, III, '29 (D). Salesman, Glenerry Woolen Company, New York City.

Greenbaum, Hyman Herbert, IV, '35 (B.T.C.). Assistant Dyer, Merrimack Hat Corporation, Amesbury, Mass.

Greenberg, Archie, II, '21 (D). Wholesale Dry Goods, Archie Greenberg, Inc., Worcester, Mass.

Greendonner, George John, Jr., IV, '30 (B.T.C.). With National Aniline & Chemical Co., Inc., Buffalo, N. Y.

Greenwood, John Roger, II, '27 (D). Superintendent, W. W. Windle Company, Millbury, Mass.

Gregory, Robert Crockett, VI, '34 (B.T.E.). Textile Engineer, Firestone Tire & Rubber Co., Akron, Ohio.

Griffin, Vernon Harcourt, IV, '35 (B.T.C.). Overseer of Finishing and Dyeing, Samson Cordage Works, Shirley, Mass.

Gross, Herman Peter, IV, '30 (B.T.C.). 94 Shanley Avenue, Newark, N. J.

Guild, Lawrence Winfield, VI, '27 (B.T.E.). Sales Executive, L. W. Guild Company, Inc., 71 Kneeland Street, Boston, Mass.

Gwinnell, George Harry, II, '25 (D). Head Designer, Berkshire Woolen Company, Pittsfield, Mass.

Gyzander, Arne Kolthoff, IV, '09 (D). Chemist, National Aniline and Chemical Co., Inc., 40 Rector Street, New York City.

Haddad, Nassib, VI, '23 (B.T.E.). Textile Engineer, General Laboratory, United States Rubber Products, Inc., Passaic, N. J.

Hadley, Richard Francis, IV, '22 (B.T.C.). Salesman, Parks & Woolson Machine Company, Springfield, Vt.

Hadley, Walter Eastman, IV, '08 (D). Chief Chemist, Standard Coosa Thatcher Company, Chattanooga, Tenn.

Hadley, Wilfred Nourse, II, '22 (D). Manager, Parks & Woolson Machine Company, Springfield, Vt.

Hager, Hazen Otis, II, '21 (C). Manager, Suburban Gas and Equipment Company, Portland, Maine.

Hale, Alfred Sandel, IV, '09 (D). Vice-President and Treasurer, Liondale Bleach, Dye & Print Works, Rockaway, N. J.

Hale, Ralph Edgar, IV, '31 (B.T.C.). Textile Chemist, The Bell Company, Worcester, Mass.

Hall, Frederick Kilby, VI, '24 (B.T.E.). (A.M. 1930, The George Washington University.) First Lieutenant, U. S. Army Quartermaster Depot, Philadelphia, Pa.

Hall, Stanley Arundel, IV, '31 (B. T. C.). With Haverhill Electric Co., Haverhill, Mass.

Halsell, Elam Ryan, I, '04 (C). Assistant Superintendent, Whittenton Manufacturing Company, Taunton, Mass.

Hammond, Chester Twombly, II, '23 (D). Sales Organization, Mohawk Carpet Mills, Inc., Boston, Mass.

Hanscom, Edwin Thomas, II, '27 (D). Superintendent, Hartford Woolen Company, Hartford, Vt.

Hardie, Newton Gary, I, '23 (D). Superintendent, Inman Mills, Inman, S. C.

Hardman, Joseph Edwin, IV, '32 (B.T.C.). 1102 Chelmsford Street, Chelmsford, Mass.
Hardy, Philip Lewis, VI, '10 (D). Contractor, Andover, Mass.
Harmon, Charles Francis, I, '99 (D).
Harrington, Thomas, IV, '15 (D). President, Hart & Harrington, 925 Weed Street, Chicago, Ill.
Harris, Charles Edward, I, '05 (D). Superintendent, Martin Trailer Company, Westfield, Mass.
Harris, George Simmons, I, '02 (C.) Treasurer, Springs Cotton Mills, Lancaster, N. C.
Harrison, Mrs. Arthur (Goodhue, Amy Helen), 111b, '00 (C). R. F. D. No. 2, Lowell, Mass.
Hart, Arthur Norman, IV, '19 (B.T.C.).
Hart, Howard Roscoe, I, '23 (D). General Superintendent, Greenwood Cotton Mill, Matthews Cotton Mill, Ninety-Six Cotton Mill, Greenwood, S. C.
Harwood, Ralph, IV, '35 (B.T.C.).
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Hathaway, William Tabor, II, '26 (D). Sanitary Engineer, Water Department, Cambridge, Mass.
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Hathorne, Berkeley Lewis, IV, '24 (B.T.C.). Consulting Chemist, Hathorne & Green, 114 East 32nd Street, New York City.
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Holgate, Benjamin, III, '02 (C). Agent, Boott Mills, Lowell, Mass.

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Parker, John George, Jr., IV, '31 (B.T.C.). Boss Dyer, Davis and Brown Woolen Company, East Killingly, Conn.

Parkin, Robert Wilson, VI, '27 (B.T.E.). Assistant Superintendent, Limerick Yarn Mills, Limerick, Me.

Parkis, William Lawton, I, '09 (D). 32 Summit Street, South Manchester, Conn.

Parsons, Charles Sumner, VI, '27 (B.T.E.). With Hathaway Manufacturing Company, New Bedford, Mass.

Peabody, Roger Merrill, II, '16 (D). Superintendent, Watson-Park Company, 261 Franklin Street, Boston, Mass.

Pearlstein, Maxwell, III, '28 (D). 37 Lawrence Avenue, Roxbury, Mass.
Pearson, Alfred Henry, IV, '11 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
Peary, John Ervin, III, '31 (D). With Wilton Woolen Company, Winthrop, Me.
Pease, Chester Chapin, I, '09 (D). Agent, Columbian Mills (Otis Company), Greenville, N. H.
Peck, Carroll Wilmot, IV, '13 (D). Vice-President, George Mann & Co., Inc., Providence, R. I.
Penney, Cabot William, III, '33 (D). Assistant Designer, Wyandotte Worsted Company, Pittsfield, Mass.
Pensel, George Robert, IV, '13 (B.T.D.). Vice-President, Ritter Chemical Company, Inc., Amsterdam, N. Y.
Perkins, John Edward, III, '00 (D). 24 Abbott Street, Pittsfield, Mass.
Perkins, J. Dean, III, '08 (D). Special Agent, Penn Mutual Life Insurance Company, Manchester, N. H.
Perlman, Samuel, IV, '17 (B.T.C.). 61 Main Avenue, Passaic, N. J.
Perlmuter, Barney Harold, IV, '23 (B.T.C.). Manufacturer, Mallon Mattress Company, Boston, Mass.
Pero, Richard Omer, II, '31 (D). Intervale Mills, Inc., Quinebaug, Conn.
Peterson, Eric Arthur, IV, '31 (B.T.C.). Chemist, Wyandotte Worsted Company, Waterville, Me.
Petty, George Edward, I, '03 (C). Real Estate, 211 Ashe Street, Greensboro, N. C.
Phaneuf, Maurice Philippe, III, '20 (D). Accountant, Librarie St. Michel, Boston, Mass.
Phelan, Bernard Michael, IV, '29 (B.T.C.). Assistant Dyer, National Aniline and Chemical Co., 351 Abbott Road, Buffalo, N. Y.
Phelan, Leonard John, IV, '35 (B.T.C.). Chemist, National Aniline & Chemical Co., Buffalo, N. Y.
Pierce, George Whitwell, IV, '25 (B.T.C.). Superintendent of Dyeing and Finishing, Kramer Hosiery Company, Nazareth, Pa.
Piligian, Hiag Nishan, IV, '32 (B.T.C.). Assistant Dyer, Bay State Thread Works, Springfield, Mass.
Pillsbury, Ray Charles, I, '13 (D). Superintendent, Cheney Brothers, Manchester, Conn.
Pizzuto, Joseph James, Jr., IV, '33 (B.T.C.). 65 Circular Avenue, Pittsfield, Mass.
Plaisted, Webster E., II, '18 (D). Superintendent of Woolens, Pacific Mills, (Worsted Division), Lawrence, Mass.
Plovnick, Max David, IV, '35 (B.T.C.). Chemist, Moleo Products Company, Everett, Mass.
Poremba, Leo Louis, IV, '35 (B.T.C.). With Pacific Print Works, Lawrence, Mass.
Potter, Carl Howard, I, '09 (D). Direct Mill Agent and Broker, 100 Worth Street, New York City.
Pottinger, James Gilbert, II, '12 (D). Director in charge of Purchasing, Reliance Manufacturing Company, 212 West Monroe Street, Chicago, Ill.
Powers, Walter Wellington, IV, '20 (B.T.C.). Divisional Works Manager, Fiberloid Corporation, Indian Orchard, Mass.
Pradel, Alois Joseph, III, '00 (D). Designer, Killingly Worsted Company Danielson, Conn.
Pradel, Mrs. Alois J. (Walker, Anna G.), IIIb, '03 (C). 78 Broad Street, Danielson, Conn.
Precourt, Joseph Octave, VI, '21 (B.T.E.). Sales Agent, January & Wood Co., 222 West Adams Street, Chicago, Ill.
Prescott, Walker Flanders, IV, '09 (D). Manager, Prescott & Co., Reg'd, 774 Saint Paul Street, West, Montreal, Can.
Preston, Harold Lawrence, VI, '30 (B.T.E.). With Chester C. Stewart, 8 Beacon St., Boston, Mass.
Proctor, Braman, IV, '08 (D). Dyestuffs Salesman, General Dyestuff Corporation, 159 High Street, Boston, Mass.

Putnam, George Ives, IV, '16 (B.T.D.). Woodbridge, New Haven, Conn.
Putnam, Leverett Nelson, IV, '10 (D). Overseer of Dyeing, Pacific Mills (Worsted Division), Lawrence, Mass.
Putnam, Philip Clayton, IV, '13 (D). Superintendent of Dyeing, Apponaug Company, Apponaug, R. I.

Quigley, Gerald Francis, IV, '31 (B.T.C.). With Franklin Rayon Corporation, Providence, R. I.
Quinlan, William Harold, VI, '20 (B.T.E.). 171 Highland Street, Worcester, Mass.

Radford, Garland, II, '20 (D). Vice-President, Oriental Textile Mills, Houston, Texas.
Ramsdell, Theodore Ellis, I, '02 (D). President, Monument Mills, Housatonic, Mass.
Rawlinson, Richard William, VI, '31 (B.T.E.). Textile Engineer, Nashua Manufacturing Company, Nashua, N. H.
Ray, Lloyd Sanford, IV, '30 (B.T.C.). Chemist and Electro Plater, Haverhill Electro-Plating Corporation, Haverhill, Mass.
Raymond, Charles Abel, IV, '07 (D). Essex, Mass.
Recher, Theodore, VI, '33 (B.T.E.). Salesman, R. Recher, Providence, R. I.
Redding, Leslie Capron, II, '26 (D). Assistant Designer, Dunn Worsted Mills, Woonsocket, R. I.
Redmond, James Reynolds, IV, '36 (B.T.C.). With Ciba Co., Inc., New York City.
Reed, Norman Bagnell, I, '10 (D). 102 Clark Road, Lowell, Mass.
Reinhold, Kurt Herman, VI, '28 (B.T.E.). Statistician, Russell Manufacturing Company, Middletown, Conn.
Reynolds, Fred Bartlett, II, '08 (D). Purchasing Agent, M. T. Stevens & Sons Company, North Andover, Mass.
Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.
Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.
Rice, Josiah Alfred, Jr., III, '20 (D). Manager, Wholesale Ginghams & Wool Goods, Marshall Field & Co., Chicago, Ill.
Rice, Kenneth Earl, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Shelton, Conn.
Rich, Edward, IV, '15 (B.T.D.). Manager, Jackson Caldwell Company, East Boston, Mass.
Rich, Everett Blaine, III, '11 (D). "Onacove," Sewall Road, Wolfeboro, N. H.
Rich, Milton Scott, II, '22 (D). 18 Norval Avenue, Stoneham, Mass.
Richardson, George Oliver, IV, '16 (B.T.D.). Manager, Special Products Division, National Aniline and Chemical Company, Inc., 40 Rector Street, New York City.
Richardson, Richardson Perry, I, '13 (D). Salesman, H. F. Livermore Company, Boston, Mass.
Riggs, Homer Chase, VI, '17 (B.T.E.). President, Riggs & Lombard, Inc., Lowell, Mass.
Ripley, George Keyes, II, '17 (D). Textile Manufacturer, Troy Blanket Mills, Troy, N. H.
Rivers, William Anthony, II, '24 (D). Resident Agent, Metropolitan Life Insurance Company, Woodstock, Vt.
Roarke, John James, IV, '36 (B.T.C.). With Geigy Company, 1244 West 103rd Street, New York City.
Robbins, Walter Archibald, VI, '30 (B.T.E.). Assistant to Plant Engineer, Columbia Mills, Inc., Minetto, N. Y.
Roberson, Pat Howell, I, '05 (C). Vice-President, Union State Bank, Pell City, Ala.
Roberts, Carrie Isabel, IIIb, '05 (C). Craft Work, 37 Grace Street, Lowell, Mass.

Robillard, Gerald Adelbert, IV, '33 (B.T.C.). Plant Chemist in Charge, Regent Knitting Mills, Ltd., St. Jerome, Que.

Robinson, Ernest Warren, IV, '08 (D). Manager, Line Division, The Shakespeare Company, Kalamazoo, Mich.

Robinson, Russell, VI, '21 (B.T.E.). Overseer, Warwick Mills, West Warwick, R. I.

Robinson, William Albert, II, '25 (D). Author and Explorer, 16 Chauncy Street, Cambridge, Mass.

Robinson, William Carleton, III, '03 (C). With Durand Shoe Company, Auburn, Maine.

Robson, Frederick William Charles, IV, '10 (D).

Rodalvicz, Francis Rudolph, IV, '28 (B.T.C.). Chemist, American Woolen Company, Andover, Mass.

Royal, Louis Merry, VI, '21 (B.T.E.). Instructor of Science and Mathematics, Pawtucket Senior High School, Pawtucket, R. I.

Rundlett, Arnold Dearborn, VI, '12 (D). Superintendent, Joseph Noone's Sons Company, Peterborough, N. H.

Runnells, Harold Nelson, IV, '25 (B.T.C.). 32 Franklin Street, Concord, N .H.

Russell, Harold William, VI, '32 (B.T.E.). With Goodall Worsted Company, Sanford, Me.

Russell, John William, IV, '20 (B.T.C.). Chemist, American Lanolin Corporation, Lawrence, Mass.

Russell, William Samuel, Jr., VI, '28 (B.T.E.). Textile Engineer, Asbestos Textile Company, North Brookfield, Mass.

Ryan, David Louis, II, '27 (D). Eastern Representative, Duplan Silk Corporation, 1450 Broadway, New York City.

Ryan, Lawrence Francis, IV, '23 (B.T.C.). Chemist, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Ryan, Millard Kenneth Thomas, Jr., II, '24 (D). Manager, American Oriental Finance Corporation, 11 Tia Ping Road, Canton, China.

Ryberg, Bertil August, IV, '29 (B.T.C.), '36 (M.S.). Research Chemist, American Association of Textile Chemists and Colorists, Lowell Textile Institute, Lowell, Mass.

Sadler, Thomas Sheridan, II, '30 (D). With Southern Asbestos Company, Charlotte, N. C.

Sampson, Clifford William, IV, '28 (B.T.C.). New England Manager, Emery Industries, Inc., of Cincinnati, Ohio, 821 Chelmsford Street, Lowell, Mass.

Sanborn, Frank Morrison, VI, '19 (B.T.E.). With Winnsboro Mills, Winnsboro, S. C.

Sanborn, Ralph Lyford, VI, '16 (B.T.E.). Assistant Purchasing Agent, Firestone Cotton Mills, Inc., Gastonia, N. C.

Sandlund, Carl Seth, VI, '25 (B.T.E.). Research, Propper-McCallum Hosiery Company, Northampton, Mass.

Sargent, Robert Edward, IV, '25 (B.T.C.). Chemist, Tubize Chatillon Corporation, 2 Park Avenue, New York City.

Sargent, Walter Ambrose, I, '22 (D). Instructor, Textile Shop Practice, Board of Education, Passaic, N. J.

Saunders, Harold Fairbairn, IV, '09 (D). 301 West 8th St., Coffeville, Kans.

Savard, Aime Albert, Jr., IV, '33 (B.T.C.). Assistant Chemist, United States Finishing Company, Sterling, Conn.

Savery, James Bryan, II, '23 (D). Assistant Sales Manager, Philgas Company, Windsor, Conn.

Sawyer, Henry Severance, VI, '32 (B.T.E.). With Sawyer, Regan Company, Dalton, Mass.

Sawyer, Richard Morey, VI, '27 (B.T.E.). (M.S., 1929, Massachusetts Institute of Technology.) Cost Engineer, Firestone Cotton Mills, Inc., Gastonia, N. C.

Scanlon, Andrew Augustine, IV, '26 (B.T.C.).

Schaetzel, André Paul, IV, '21 (B.T.C.). Chief Chemist, Associated Dyeing & Printing Corporation, Paterson, N. J.

Schneiderman, Jacob, III, '27 (D). Golf Professional and Bridge Instructor, Mt. Pleasant Country Club, Leicester, Mass.
Schoelzel, Herman Walter, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.
Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Assistant Industrial Sales Manager, Tide Water Oil Company, Boston, Mass.
Schwarz, Herman Louis, IV, '22 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.
Scott, Gordon Maxwell, IV, '20 (B.T.C.).
Shaber, Hyman Jesse, VI, '17 (B.T.E.). (M.B.A., 1922, Harvard University.) With Spencer Chain Stores, Boston, Mass.
Shah, Kantilal Hiralal, VI, '36 (B.T.E.). Student, Massachusetts Institute of Technology, Cambridge, Mass.
Shah, Shantilal Hiralal, IV, '34 (B.T.C.). Student, Harvard Business School, Boston, Mass.
Shain, Joseph, IV, '35 (B.T.C.). 41 Stanwood Street, Roxbury, Mass.
Shanahan, James Edward, II, '22 (D). Manager, Hygeia Ice & Coal Company, Amsterdam, N. Y.
Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C).
Shann, William Edwin, II, '35 (D). 169 Grove Street, Putnam, Conn.
Shapiro, Simon, VI, '34 (B.T.C.). Testing Laboratory, Gotham Silk Hosiery Company, Wharton, N. J.
Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.
Shea, John Francis, IV, '28 (B.T.C.). Demonstrator, Buffalo Electro-Chemical Co., Inc., 207 A Street, Boston, Mass.
Shedd, Jackson Ambrose, III, '28 (D). Designer, S. Stroock & Co., Inc., Newburgh, N. Y.
Shelton, Charles Leopold, VI, '29 (B.T.E.). Executive Assistant to Superintendent, Mohawk Carpet Mills, Amsterdam, N. Y.
Shenker, Nahman, III, '25 (D).
Sidebottom, Leon William, IV, '11 (D). Research Chemist, Boston Blacking & Chemical Company, East Cambridge, Mass.
Sjostrom, Carl Gustof Verner, Jr., III, '17 (D). Production Manager, Glastonbury Knitting Mills, Addison, Conn.
Slamin, Alfred Francis, I, '26 (D). Representative, Benjamin Franklin Paint Company, Philadelphia, Pa.
Sleeper, Robert Reid, IV, '00 (D). Textile Chemist, Calco Chemical Company, Bound Brook, N. J.
Smith, Allen Batterman, I, '26 (D). Turner Halsey Company, 40 Worth Street, New York City.
Smith, Doane White, II, '10 (D). 15 Oakland Street, Natick, Mass.
Smith, Frank Kenfield, II, '24 (D). Designer and Technician, Grout's, Ltd., St. Catharines, Ont.
Smith, Harold, IV, '34 (B.T.C.). 24 Belmont St., Lowell, Mass.
Smith, Herbert Jeffers, VI, '22 (B.T.E.). 84 Maple Avenue, West Warwick, R. I.
Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.
Smith, Roger Dennis, II, '27 (D). Assistant Superintendent, M. T. Stevens & Sons Co. (Pentucket Mills), Haverhill, Mass.
Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.
Snelling, Fred Newman, II, '03 (D). With the American Railway Express Company, Haverhill, Mass.
Sokolsky, Henry, VI, '17 (B.T.E.). Time Study Supervisor, B. F. Sturtevant Company, Hyde Park, Mass.
Somers, Benjamin, II, '25 (D). 128 Pleasant Street, Brookline, Mass.
Southwick, Charles Hudson, IV, '22 (B.T.C.). Assistant Dyer, Slatersville Finishing Company, Slatersville, R. I.
Spalding, Arthur Ovila, IV, '32 (B.T.C.). 84 D Street, Lowell, Mass.
Spiegel, Edward, II, '03 (C).

Stacey, Alfred Charles, IV, '30 (B.T.C.). Chemist, Shoe Lace Company, Lawrence, Mass.

Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.

Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist and Overseer of Bleaching, Certified Laboratories, Inc., Austin, Texas.

Stass, John George, II, '27 (D). Textile Analyst, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.

Stearns, Kenneth Lawrence, IV, '33 (B.T.C.). Rayon Dyeing, Arnold Print Works, North Adams, Mass.

Steele, Everette Vernon, IV, '24 (B.T.C.). Purchasing Agent, Rohm & Haas Co., Inc., Philadelphia, Pa.

Stein, William Joseph, VI, '35 (B.T.E.). Mill Representative, Charlton Mills, 66 Leonard Street, New York City.

Stephens, Arnold George, I, '29 (D). Repairing and Selling Service, Liberty Typewriter, Boston, Mass.

Stevens, Raymond Russell, IV, '19 (B.T.C.). Chief Chemist, The Felters Company, Inc., Millbury, Mass.

Stevens, William Edwin, I, '34 (D). With B. B. & R. Knight Corporation, (Royal Mill), River Point, R. I.

Stevenson, Murray Reid, III, '03 (C).

Stewart, Alexander, VI, '31 (B.T.E.). Inspector of Textiles, Quartermaster's Depot, Chicago, Ill.

Stewart, Arthur Andrew, II, '00 (D). Professor of Textiles; in charge of Finishing Department, Lowell Textile Institute, Lowell, Mass.

Stewart, John Weeden, IV, '30 (B.T.C.). Technical Demonstrator, General Dyestuff Corporation, 230 Fifth Avenue, New York City.

Stewart, Walter Lawrence, III, '03 (D).

Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Technical Adviser, Richards Chemical Works, Specialty Products Company, Onyx Oil & Chemical Co., Jersey City, N. J.

Stohn, Alexander Charles, III, '06 (C). General Superintendent, Carl Stohn, Inc., Hyde Park, Mass.

Stolzberg, Howard Nathaniel, IV, '35 (B.T.C.). Chemist, Suffolk Knitting Company, Lowell, Mass.

Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.

Storer, Francis Everett, II, '07 (D). Meredith, N. H.

Storey, Alvin Briggs, VI, '28 (B.T.E.). Assistant Superintendent, Textile Division, Celanese Corporation of America, Cumberland, Md.

Stott, John Smith, III, '28 (D). With Newmarket Manufacturing Company, Lowell, Mass.

Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.

Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, New Haven, Conn.

Sturtevant, Albert William, IV, '17 (D). Automobile Mechanic, Lowell Motor Sales, Inc., Lowell, Mass.

Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist, Naugatuck Chemical Division, United States Rubber Products, Naugatuck, Conn.

Suhlke, Waldo Eric, IV, '20 (B.T.C.). Teacher, Jefferson Junior High School, Meriden, Conn.

Sullivan, John David, VI, '12 (D). With Robert Gair Company, Bradford, Mass.

Sullivan, Lambert William, II, '23 (D). Instructor in Woolen Mill, Massachusetts Reformatory, West Concord, Mass.

Sullivan, Willard David, II, '23 (D). 39 Loring Street, Lowell, Mass.

Sunbury, Herbert Ellsworth, VI, '18 (B.T.E.). Vice President, Allbestos Corporation, 21st & Godfrey Avenue, Germantown, Philadelphia, Pa.

Sutcliffe, Henry Mundell, II, '25 (D). Overseer, Uxbridge Worsted Company (Granite Mills), Pascoag, R. I.

Sutton, Leslie Emans, I, '17 (D). Manager & Superintendent, Anniston Cordage Company, Anniston, Ala.

Swain, Harry LeRoy, Jr., I, '26 (D). With Firestone Tire & Rubber Co., Akron, Ohio.

Swan, Guy Carleton, II, '06 (D). Chief Chemist, New York Food and Drug Inspection Station, 201 Varick Street, New York City.

Swanson, John Harold, I, '28 (D). Designer, Georgia Kincaid Mills, Griffin, Ga.

Sweeney, George Hamilton, II, '24 (D). Salesman, Walker Stetson Company, 157 Essex Street, Boston, Mass.

Swift, Edward Spooner, S. J., I, '02 (D). Clergyman, Church of the Immaculate Conception, Boston, Mass.

Syme, James Francis, II, '00 (D). Industrial Management, 27 Linnaean Street, Cambridge, Mass.

Symmes, Dean Whiting, IV, '22 (B.T.C.). Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

Tamulonis, Edward William, VI, '30 (B.T.E.). In charge of Production, Routing, and Scheduling, Newmarket Manufacturing Company, Lowell, Mass.

Tang, Hsiung-Yuan, I, '30 (D). Assistant Manager, Sung Sing Cotton Mill, No. 3, Vice President & Works Manager, Yih, Hsing Woolen & Worsted Mills, Wusih, Kiangsu, China.

Tarpey, Thomas Joseph, IV, '27 (B.T.C.). 23 Fremont Street, Somerville, Mass.

Tarshis, Elias Aaron, IV, '28 (B.T.C.).

Teague, Charles Baird, II, '26 (D). Civil Engineer, Highway Division, Massachusetts Public Works Department, Boston, Mass.

Thaxter, Joseph Blake, Jr., II, '12 (D). Assistant Selling Agent, Ludlow Manufacturing & Sales Corporation, 211 Congress Street, Boston, Mass.

Thomas, Benjamin, Jr., VI, '34 (B.T.E.). Overseer, Jackson Mills, Nashua, N. H.

Thomas, Robert Joseph, IV, '34 (B.T.C.). Graduate Student and Assistant Instructor, Department of Chemistry, University of Notre Dame, Notre Dame, Ind.

Thomas, Roland Vincent, I, '05 (C). With Chicopee Sales Corporation, 40 Worth Street, New York City.

Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc., Charlotte, N. C.

Thompson, Everett Leander, I, '05 (D). 53 Morse Avenue, Brockton, Mass.

Thompson, George Robert, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.

Thompson, Henry James, IV, '00 (D). 15 Greenleaf Street, Malden, Mass.

Todd, Walter Ernest, III, '23 (D). Resident Agent, Metropolitan Life Insurance Company, Uxbridge, Mass.

Toepler, Carl, IV, '22 (B.T.C.). Supervisor in charge of Finishing Department, Bellman Brook Bleachery Company, Fairview, N. J.

Toher, Francis Luke, IV, '32 (B.T.C.). 58 Concord Street, Providence, R. I.

Topjian, Leon, IV, '30 (B.T.C.). 416 Massachusetts Avenue, Boston, Mass.

Toshach, Reginald Alexander, II, '11 (D). Proprietor, Toshach's Mill Remnants, Haverhill, Mass.

Toupin, Stephane Frederick, VI, '24 (B.T.E.). Plant Engineer, Regent Knitting Mills, Ltd., St. Jerome, Quebec.

True, William Clifford, II, '22 (D). Night Superintendent, Ludlow Manufacturing & Sales Co., Allentown, Pa.

Turcotte, David Henry, IV, '33 (B.T.C.). 523 Fletcher Street, Lowell, Mass.

Tyler, Bernard James, IV, '36 (B.T.C.). Textile Testing, United States Testing Company, Hoboken, N. Y.

Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Portsmouth, N. H.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.

Valentine, Preston Sumner, IV, '36 (B.T.C.). With Nye-Waite Kilmarnock

Varnum, Arthur Clayton, II, '06 (D). Superintendent, Pioneer Mill, Pittsfield, Me.

Villa, Luis Jorge, IV, '25 (B.T.C.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

Villa, William Horace, VI, '24 (B.T.E.). Technical Director, Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

Villeneuve, Maurice Arthur, II, '26 (D). With Killingly Worsted Mills, Danielson, Conn.

Vincent, William Henry, III, '26 (D). 18 Albion Street, Hyde Park, Mass.

Walen, Ernest Dean, VI, '14 (B.T.E.). General Manager, Pacific Mills (Worsted Division), Lawrence, Mass.

Walker, Alfred Schuyler, II, '11 (D). 67 Park Avenue, Saranac Lake, N. Y.

Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.

Walker, Raymond Scott, II, '23 (D). Engineer, Wood Mills, Lawrence, Mass.

Walker, Samuel J., IV, '32 (B.T.C.). Fitzgerald & Walker, Main Street, Winchester, Mass.

Wallace, Joseph Max, IV, '31 (B.T.C.). With Enequist Chemical Company, 255 Freeman Street, Brooklyn, N. Y.

Wang, Chen, IV, '23 (B.T.C.).

Wang, Cho, VI, '23 (B.T.E.).

Wang, Tung Chuan, VI, '23 (B.T.E.).

Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.

Wang, Yung Chi, II, '21 (D).

Ward, George Chester, IV, '28 (B.T.C.). Research Chemist, Celanese Corporation of America, Cumberland, Md.

Warren, E. Maybelle, IV, '28 (B.T.C.). Chemist, Hub Hosiery Mills, Lowell, Mass.

Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

Washburn, John Milton, Jr., IV, '21 (B.T.C.). Salesman, Colgate-Palmolive-Peet Company, Boston, Mass.

Watson, William, III, '11 (D). Real Estate, Frank E. & Wm. Watson, 50-54 Merrimack Street, Haverhill, Mass.

Webber, Arthur Hammond, IV, '01 (D). Colorist, Irving Tanning Company, Peabody, Mass.

Webster, Joseph Albert, VI, '23 (B.T.E.). Superintendent, Cloth Division, Aberfoyle Manufacturing Company, Chester, Pa.

Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.

Welch, William Paul, Jr., IV, '36 (B.T.C.). 76 South Highland Street, Lowell, Mass.

Wells, Ai Edwin, VI, '20 (B.T.E.). Assistant Professor, Mechanical Engineering, Lowell Textile Institute, Lowell, Mass.

Wells, Henry Alfred, Jr., IV, '33 (B.T.C.). Chemist and Color Mixer, Warwick Print Works, Inc., Bound Brook, N. J.

Westaway, John Chester, VI, '28 (B.T.E.). Secretary-Treasurer, W. J. Westaway Co., Ltd., Hamilton, Ont.

Westbrooke, Clayton Collington, IV, '29 (B.T.C.). Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.

Wetherbee, Francis Putney, I, '28 (D). Plant Manager, Flint River Cotton Mills, Albany, Ga.

Wheaton, Walter Francis, VI, '23 (B.T.E.). Stationer, Walter F. Wheaton, White Plains, N. Y.

Wheelock, Stanley Herbert, II, '05 (D). President and Treasurer, Stanley Woolen Company, Uxbridge, Mass.

Whitcomb, Roscoe Myron, IV, '10 (D). Pharmacist, R. M. Whitcomb, Ashland, N. H.

White, Royal Phillip, II, '04 (D). With Leominster Mills, Inc., Leominster, Mass.

Whitehill, Warren Hall, IV, '12 (D). Textile Chemist, Talbot Mills, North Billerica, Mass.

Wightman, William Henry, IV, '06 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
Wilcox, Leonard Edward, VI, '24 (B.T.E.). 49 Varnum Avenue, Lowell, Mass.
Wilkie, Robert Campbell, VI, '34 (B.T.E.). Wool Technician, Frosted Wool Process Company, 10 High Street, Boston, Mass.
Williams, Albert William, III, '32 (D). Assistant Stylist, Joshua L. Bailey, New York City.
Williamson, Douglas Franklin, I, '22 (D). Superintendent, Allred Plant, Granite Falls Manufacturing Company, Granite Falls, N. C.
Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.
Wilson, Raymond Bachman, II, '36 (D). With Lorraine Mfg., Co., Pawtucket, R.I.
Wing, Charles True, III, '02 (D). Paymaster, Merrimack Woolen Corporation, Dracut, Mass.
Wingate, Edward Lawrence, Jr., VI, '28 (B.T.E.). Assistant to Superintendent, Russell Manufacturing Company, Middletown, Conn.
Wingate, William Henry, IV, '08 (D). Superintendent, Hodges Finishing Company, Dedham, Mass.
Wise, Paul Tower, II, '01 (D). President, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.
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A STUDY OF SOME OF THE FACTORS THAT ALTER THE COLOR AND THE STAPLE LENGTH OF FROSTED AND REGULAR WOOL

By James H. Kennedy, Jr., B.T.E.,
Instructor in Wool Yarns and Sorting.

The purpose of this paper is to present the results of a thesis which has been prepared under the direction of Professor Herbert J. Ball, in charge of the Department of Textile Engineering. The thesis was a partial requirement for the degree of Bachelor of Textile Engineering.

PURPOSE

The specific objectives of the thesis were as follows:

(1) To measure the color of Frosted and Regular wool top.

(2) To study the factors that influence the color difference.

(3) To compare staple diagrams of Frosted wool top with those of Regular wool top, and

(4) To analyze the factors that change the average staple length of top.

PROCEDURE

A carefully sorted lot of wool containing excessive vegetable matter was cone dusted and then subdivided into two parts. One of these was further divided into several smaller lots for processing into Regular wool top. The other part was passed through the Frosted Wool Process, and then divided into several smaller lots for processing into Frosted wool top.

Test lots of the Frosted wool and the Regular wool were scoured with soap and alkali in clean, medium dirty and dirty scouring bowls; a comparison test with naphtha-treated wool followed by a clear water rinse was also made. Other tests varied the number of bowls in the scouring process.

The tests for color were made on a Gaertner Spectrophotometer and checked on a Hardy Color Analyzer. The tests for average staple length were made on a Suter Wool Top Sorter.

A summary of the procedure followed and of the results obtained is given in Table I.

TABLE I

Summary of Procedure and Results of Tests

Test No.	State of Bowls	Bowls used	Card	Weighted Average Reflection of top (%)	Average Staple of top (mm.)
1R	Clean	1, 2, 3, 4	Woolen	36.3	78.3
2F	Clean	1, 2, 3, 4	Woolen	38.6	76.3
3R	Medium	1, 2, 3, 3, 4	Woolen	33.1	81.2
4R	Medium	1, 2, 4	Woolen	34.0	78.3
5R	Medium	1, 4	Woolen	34.0	80.5
6R	Medium	1, 2, 3, 4	Woolen	34.6	81.8
7R	Medium	1, 2, 3, 4	Worsted	36.8	77.9
8F	Medium	1, 2, 3, 4	Woolen	36.8	81.6
9F	Medium	2, 4	Worsted	33.3	73.1
10F	Medium	2, 3, 4	Woolen	34.7	78.4
11F	Medium	2, 4	Woolen	33.2	72.5
12R	Dirty	1, 2, 3, 4	Woolen	30.1	71.8
13F	Dirty	1, 2, 3, 4	Woolen	30.5	67.6
14R	Naphtha plus	3, 4, 4 rinse	Woolen	31.7	76.8
15R	Naphtha plus	3, 4, 4 rinse	Worsted	31.8	71.5
16F	Naphtha plus	3, 4, 4 rinse	Woolen	32.4	78.2
17F	Naphtha plus	3, 4, 4 rinse	Worsted	33.9	72.2

Note: F = Frosted Process
R = Regular Process

CONCLUSIONS

1. Frosted wool top had better color than Regular wool top processed in the same manner.

2. The color of top, both Frosted and Regular, varies with the degree of cleanness of the scouring liquor.

3. Dirty scouring liquor stains wool and results in a poor color that does not rinse out.

4. Four bowls of scouring for Frosted wool produce top of better color than do three or less.

5. Naphtha-treated wool, followed by a three bowl rinse, produces a top inferior in color to top made by soap and soda scouring.

6. Medium dirty scouring bowls produce a top of maximum staple length.

7. Dirty scouring bowls produce a top of minimum staple length.

8. The staple length of Frosted wool and Regular wool tops scoured in medium dirty scouring bowls are alike.

9. The staple length of naphtha treated Frosted wool is slightly longer than that of naphtha treated Regular wool.

10. Under certain conditions the frosted process tends to decrease somewhat the fiber length of top.

11. The wool scouring process appears to have more effect on the length of staple in the top than the frosting process.

COMMENTS

This study shows conclusively that not only does the method of scouring affect the color of the finished top but that it also affects the staple length of the top. It will be noted that clean scouring bowls do not produce top of maximum staple length. This is probably due to the fact that the natural potash salts in the grease wool which assist scouring have not accumulated sufficiently in the scouring liquor. This same reason may account in part for the consistently poorer color of naphtha-treated wool as compared with that of soap and soda scoured wool.

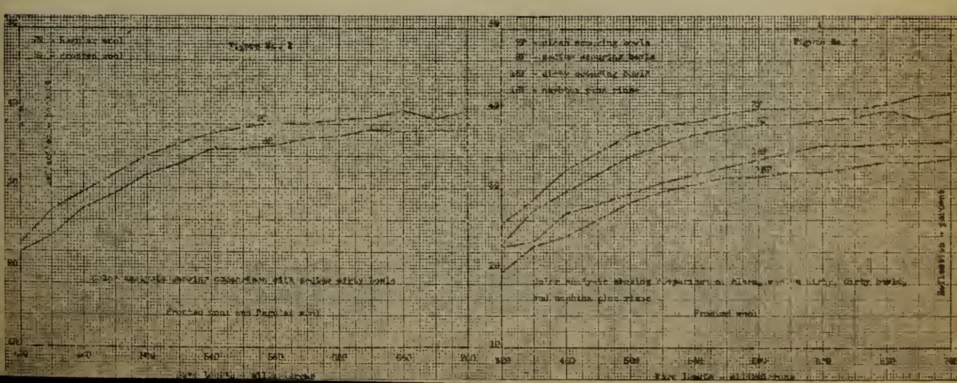
The maximum variation in staple length of Regular soap and soda scoured wool is 10 mm. while for Frosted soap and soda scoured wools the maximum variation in staple length is 14 mm. The maximum variation in staple length of both Frosted and Regular wools when scoured alike by soap and soda is 4.2 mm. These facts indicate that the difference in staple length between the two kinds of tops is due more to the scouring process than to whether the tops have been treated by the Frosted or Regular process.

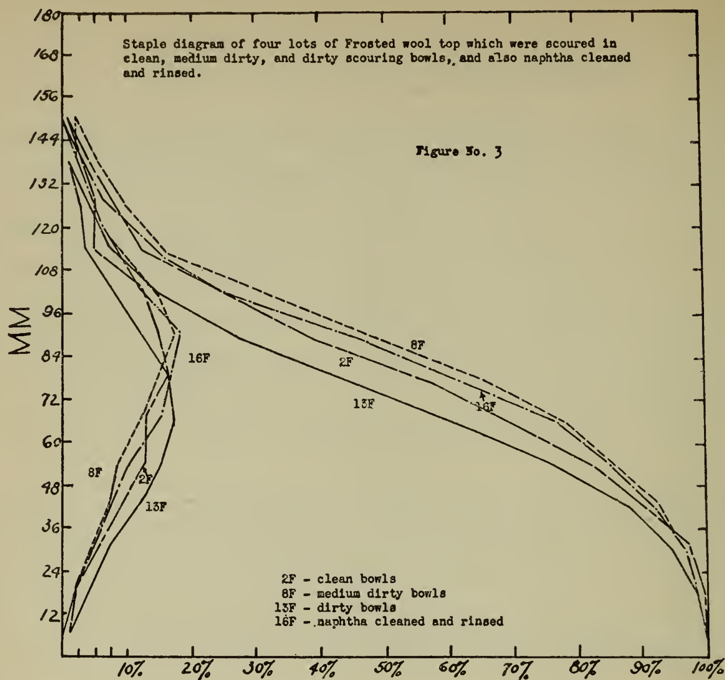
Figure 1 shows a color analysis of Frosted and Regular wool tops which have been scoured in medium dirty bowls.

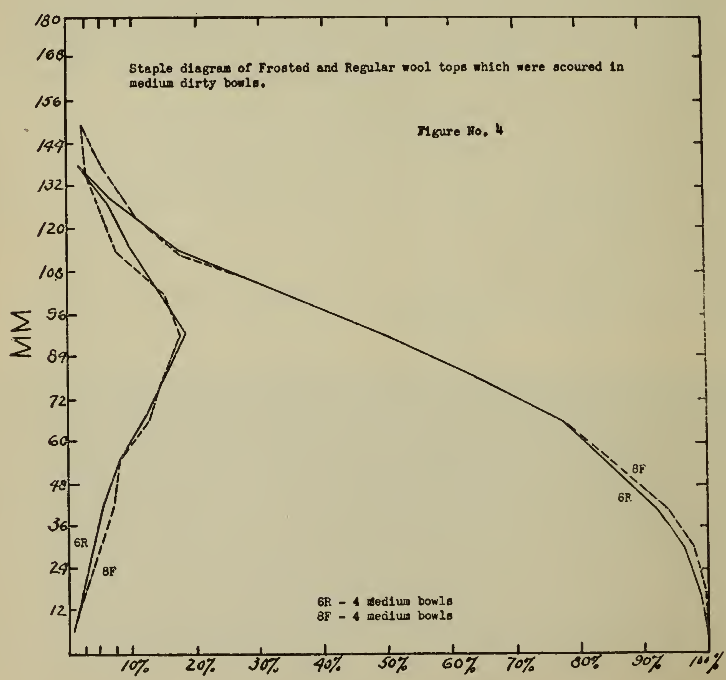
Figure 2 shows a color analysis of four lots of a Frosted wool top which were scoured in clean, medium dirty, and dirty scouring bowls, and also naphtha cleaned and rinsed, respectively.

Figure 3 shows a staple diagram of the same lots of Frosted wool top as described in Figure 2 above.

Figure 4 shows a staple diagram of Frosted and Regular wool tops which were scoured in medium dirty bowls.




Staple diagram of four lots of Frosted wool top which were scoured in clean, medium dirty, and dirty scouring bowls, and also naphtha cleaned and rinsed.
Figure No. 3
MM
180
168
156
144
132
120
108
96
84
72
60
48
36
24
12
8F
2F
16F
13F
2F - clean bowls
8F - medium dirty bowls
13F - dirty bowls
16F - naphtha cleaned and rinsed
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%


Staple diagram of Frosted and Regular wool tops which were scoured in medium dirty bowls.
Figure No. 4
MM
180
168
156
144
132
120
108
96
84
72
60
48
36
24
12
8F
6R
6R - 4 medium bowls
8F - 4 medium bowls
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

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DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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LOWELL EVENING TEXTILE SCHOOL

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1937.

September 23, Thursday	Registration.
September 30, Thursday	Registration.
October 4, Monday	Opening of evening school.
October 12, Tuesday	Columbus Day—Holiday.

November 11, Thursday	Armistice Day—Holiday.
November 25, Thursday, November 26, Friday	Thanksgiving recess. No classes.
December 17, Friday	End of first term.
1938.	
January 3, Monday	Opening of second term.
February 22, Tuesday	Washington's Birthday—Holiday.
March 11, Friday	Closing of evening school.
April 6, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week*. Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

The course in Organization, which is offered only to those who have completed the work in Carding and Spinning, is a relatively new course given in response to a demand for this type of instruction.

110. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cottons desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, spooling, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary charasteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

114. Cotton Organization—1 Year.

The course in Organization is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative

problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 212) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

212. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

Technology of Wool Fibres—*one evening each week.*

Raw Materials.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc. is available for outside reading or study.

Wool Scouring.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

Carbonizing.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

Worsted Carding and Combing—*one evening each week.*

Carding.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

Combing.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

Mechanism and Calculations—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

213. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dye-stuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium

mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT

510. English Composition—2 Years.

Remedial English and Rhetoric—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building

up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

Problems in the Interpretation and the Appreciation of Literature—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horse-power, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626. Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the

main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1937.

Certificates awarded as follows, April 1, 1937:

Cotton Yarns—2 Years.

John Burton Austin	Reading
Anthony Henry Devaney	Lowell

Knitting—1 Year.

William Ball	Methuen
John Christison	Methuen
Frederick Nelson Dickey	Lowell
John Brown Hunter	Chelmsford

Woolen Yarns—2 Years.

Frank David Carroll, Jr.	Lowell
Richard Hubbard Cook	Lowell
Max Cooperstein	Malden
George William Daley	Haverhill
Oliver Damon	North Billerica
John Ollier Darlington, Jr.	Methuen
Joseph Thomas Fox	North Andover
Bert Gilbert	Methuen
Harvey Arthur Joyal	Lowell
Christopher Lawrence Muller	Andover
Thomas Bernard Murray	Lawrence
Benjamin Franklin Savage, Jr.	Lowell
Alexander Soucey	Lawrence
Edward Lee Spaulding	Billerica
Robert Griffin Thompson	Haverhill
Alexander Vervaert	Lowell
Fred Whitaker	Andover
Harold Robb Wilcox	Maynard

Worsted Yarns—2 Years.

George Sykes Archer	Lowell
Frank Salvatore Cefalu	Lawrence
John Milton Cole	Methuen
Leslie Frank Currier	Lowell
Edwin Cragin Deming	Lawrence
James DiLavore	Methuen
James Woodrow Donovan	Lawrence
Bruno Stanley Dzioba	Lawrence
Anthony Frank Fallisi	Lawrence
James George Hetherington	Methuen
John Holden	Lawrence
Ralph Smith Howard	Methuen
Joseph Hugh Keenan	Lawrence
Arthur Long	Methuen
William Matal	Lawrence
Lawrence Robinson Poole	Methuen
Millage Stennett Rawnsley	Lowell
Peter Sechovich	Forge Village
John Hollywood Shinner	Methuen

Cotton Design—3 Years.

Joseph Wilfred Gionet	Shirley
Lucien Johnston Harmon	Lowell
William Nathaniel Hunt	Lowell
Ralph Stanton Pushor	Lowell

Woolen and Worsted Design—3 Years.

Joseph Linwood Allen, Jr.	Methuen
Chester Arthur Brown	Lowell
Leslie Newell Center	Wilton, N. H.
Otis Edmund Fairfield	Wilton, N. H.
Joseph Leo FitzGerald	Milford, N. H.
John Fraser Giffin	Wilton, N. H.
Alfred Greenfield, Jr.	Andover
Wallace Hall	Lawrence
Frederick Richard Holt	North Andover
Walter Augustine Jackson	Methuen

Julius James Karacieus, Jr.	Lawrence
Raymond Maxime Lafortune	Lowell
Romeo David Legare	North Andover
William Paul McCarthy	Lowell
John Nauiokas	Lawrence
Evariste Joseph Pepin	Lowell
Wallace Rennie	North Andover
William Maxwell Thomson	Lawrence
Noble Wright	Lawrence

Advertising Design—2 Years.

Cyril Andrew Gordon	Lowell
Henry Adoulf Hansen	Lowell
Mary Mabel Higgins	Lowell
George Gladstone Pardoe	Lowell
Bernard Joseph Ready	Lowell
Arthur Warren Stancombe	Lowell
Elias Stavropulos	Lowell

Decorative Art—3 Years.

George Elbert Bowring	Lowell
John Francis Dowling	Lowell
Alice Foye McCarthy	Lowell
Beatrice Veracunda Newhall	Lowell
Roswell Thomas Wallwork	Lowell

Cotton Weaving—1 Year.

Christos Anganes	Lowell
Arthur Dinis Boucher	Lowell
Leo Thomas Fortier	Lowell
Alexandria Ann Koroski	Lowell
Charles Tzikopoulos	Lowell
Frederick Ernest Whitehouse	Tewksbury

Loom Fixing—1 Year.

Norbert Joseph Aubin	Lawrence
Joseph Boothroyd	Maynard
Victor Brouillette	Lowell
Roland William Dumais	Nashua, N. H.
Walter Henry Graichen	Methuen
Stanley Joseph Krysiak	Lowell
George Henry Matthews	Lowell
Joseph Edward Michalewicz	Lawrence
Robert Mills	Methuen
Adelard St. Amand	Lowell
Sylvester Arthur Thomas	Shirley
Herbert Empsel Willman	Lowell

Woolen and Worsted Weaving—1 Year.

Anthony John Bush	Lawrence
Ralph Collinson	Methuen
Norman Francis Farah	Lowell
James Peter Farrah	Lowell
Joseph Andre Gagnon	Lowell
Leo Henry Gelineau	Lowell
Alfred Gendron	Lowell
Albert Guerin	Lawrence
Frank William Henry	Lowell
Ross Merrill Howes	Lawrence
Thomas Kady	Methuen
Thomas George Kibildis	Lawrence
Thomas Frederick LeLacheur	Lowell
Aubrey Oland Lightfoot	Lowell
John Joseph McHugh	Lowell
Maurice Roland Marchand	Lowell
Malcolm Murphy	Andover
Richard Holden Olney	Lowell
Frank Neil Piessens	Lawrence
Charles Henry Redman	Lowell
Alonzo Flavian Roy	Lawrence
Wilfred Roy	Lawrence

Albert Stravinskas	Methuen
Hipalit Warren Szuflicki	Lawrence
Alexander Edward Thurber	East Chelmsford
Stanley Warchot	Lawrence
Toivo Aimas Wick	Maynard

Woolen and Worsted Finishing—1 Year.

Charles Peter Averka	Lawrence
Hollis Goodenow Barlow	Maynard
Lester Raymond Barrington	Billerica
James Leo Batts, Jr.	Methuen
Hubert Joseph Beaumier	Lowell
Ernest Augustus Borden	Bradford
George Edward Buckley	Lowell
Arthur Bernard Charlesworth	Methuen
Rufus Edward Corlew	Lowell
Arthur James Flanagan	North Andover
William Dixon Glennie	North Andover
Warren Cleveland Hall	Andover
Wilfred Sidney Laporte	Lowell
Laban Ewart McComish	North Andover
Walter Stoddart MacLauchlan	Methuen
Thomas Marsden	Maynard
Dennis Joseph Murphy	Lowell
E. Geoffrey Nathan	Brookline
Charles Thomas Neild	Lowell
George Washington Pihl	Lowell
Seward Proctor	Lowell
John Arnold Ratcliffe	North Andover
Benjamin Booth Ross	Lawrence
Joseph Francis Ryan	Lawrence
Howard Sherlock	Methuen
John Miller Shields, Jr.	Lawrence
George Olney Steere	Methuen
Ernest Asa Stocks	Andover
Frank DeWitt Tallmadge	Methuen
Carl Arthur Thomas	North Andover
William Joseph Viel	Lawrence
Alden Robert Walls	Andover

Textile Chemistry and Dyeing—3 Years.

Simon Bachner	Roxbury
Otis Caton Gorman	Nashua, N. H.
George Augustine Molloy	Lawrence
William Alexander Page	Andover
Harry Richardson	Lawrence
Isaakas Sapirsteinas	Brookline

Analytical Chemistry—3 Years.

Edward Herbert Ryan	Lowell

Elementary Chemistry—2 Years.

Walter Akam	Methuen
Gordon Barber	Lawrence
Robert Francis Bastow	North Billerica
Joseph Harper Binns	North Andover
Harry Robert Buckley	Methuen
Fred Arthur Buthmann	Lawrence
Edward Camara	Lowell
Frederick David Clement	Lowell
Raymond Arthur Flanders	Methuen
Robert William Ginivan	Lowell
Frank Parker Hatch	Haverhill
Joseph Warren Hogan	Lowell
Mildred Josephine Holmes	Lowell
Maurice Jones	Methuen
Hamilton Tillman McClay	Mattapan
Allan Cleveland Milnes	Andover
Gerard Charles Morel	Lawrence
Francis Elmer Mosher	Lawrence
Daniel Dominic Murphy	Lowell

Clare William Norton, Jr.	Andover
David Barlow Parker	Lawrence
Armand Joseph Patenaude	Lowell
Harry Woolley Pratt	Lawrence
Norman Eric Roberts	Lawrence
Cornelia Anne Rodopoulos	Lowell
Edward Saba	Lowell
Thomas Joseph Scanlon	Lawrence
Alfred Walter Scheer	Nashua, N. H.
Earl Frederick Schubert	Methuen
Albert Lester Sugden	Methuen
Louise Anna Rose Sullivan	Tewksbury
Chester Volney Sweatt	Westford
William Peter Tsaffaras	Lowell
Benjamin Wolff	Lowell
Walter Joseph Wood, Jr.	Methuen
Walter Benjamin Worsman	Methuen

Mechanical Drawing—3 Years.

Remy Delphias Bertrand	Lowell
Real Emil Joseph Bolduc	Lowell
Clarence Marshall Dean	Forge Village
Arthur DeSpencer	Lawrence
Edwin Joseph Flagg	Lawrence
Frederick Bradford Martin	North Billerica
Michael James Shyne	North Andover

Alternating Current Electricity—2 Years.

Edward Francis Cassidy	Lowell
John Henry Graham	Lowell
Lucien Henry Haesebrouck	Lowell
Russell Charles Sheehan	Lowell
George Francis Spencer	Lowell
Ralph Emmons Tweed	Lowell

Direct Current Electricity—2 Years.

Peter Anderson	Andover
Remy Delphias Bertrand	Lowell
Real Emil Joseph Bolduc	Lowell
Alfred Walker Burgess	Lawrence
William Paul Jonis	Lowell
John Alexander Kasinskas	Lowell
Francis Xavier Lavallee	Lowell
Wilfred Charles Lynch	Lowell
Alexander Markewich	West Windham, N. H.
George James Megdanis	Lowell
Edward Francis Moran	Lowell
Arthur Loring Tisdale, Jr.	North Chelmsford

Machine Shop Practice—2 Years.

Francis Claudius Barry	Lowell
Raymond Irving Buchanan	Lowell
Raymond Joseph Demers	Lowell
John Stanley Fowler	Billerica
Edward Whitelaw Galaher	North Andover
Walter Lucien Gauthier	Lowell
John Edgar Greenwood	Lowell
Reginald Francis Horman	North Billerica
Mitchell Arthur Jason	Lowell
William Robertson Kiesling	Methuen
David Rae Liddle	North Andover
Armand Gerard Morin	Lowell
Edward Felix Padonevitch	Lowell
Joseph Michael Quinn	Maynard
William Henry Roy, Jr.	Lowell
Henry Emmanual Wazlaw	Lawrence

Mathematics—2 Years.

Thomas Edwin Banks	Lowell
Wilfred Bottomley	North Andover
Costas John Chiungos	Lowell
John Kain Clark	Lowell

Edward Robert Flood	Lowell
Edward Leo Garrity	Lowell
Philip Henry Goulding	Lowell
Harry Fjeld Halvorsen	Chelmsford
Stephen Charles Kapernaros	Lowell
William Russell Kiernan, Jr.	Lowell
Arthur Lawrence Lambert	Lowell
Paul Eugene Longval	Lowell
Malcolm McGowan	Lowell
Dorothy Marie Roark	Lowell
Harry Scarmeas	Lowell
Robert Harrison Stickney	Lowell
Michael Valentine Torla	Lawrence

Steam—1 Year.

John Bernard Gallagher	Lowell
Burton Allan Gould	Lowell
Paul Eugene Phelan	Nashua, N. H.
William Eric Wood	Lowell

Mechanics—1 Year.

Origene Joseph Allard	Lowell
Robert Alfred Fischer	Lawrence

Diesel Engines—1 Year

Joseph Thomas Ahern	Lawrence
Charles Lowe Aiken	Methuen
William Gail Alberghene	Lowell
Arthur Weston Alcott	Lowell
Lawson Wetmore Allaby	Lowell
Allan Angus	Lowell
Oscar Apkarian	Methuen
George Gordon Armstrong, Jr.	Littleton
Dwight Leslie Barnard	Lowell
Sidney Cyrus Barton	Lowell
Elmer Wayne Basley	Lowell
Harold Bennett	Methuen
John Edward Birchall	Lowell
Emile Blouin	Lawrence
Arthur Joseph Bourassa	Andover
Charles Parsons Brooks, Jr.	Melrose
Louis Gordon Buker	North Billerica
William Augustine Cannon, Jr.	Lawrence
Joseph Francis Carney	Lowell
Thomas Clark, Jr.	North Andover
Patrick Francis Comer	Lowell
David Albert Constantine	Lowell
Matthew Stanley Czubacki	Lawrence
Allan Dawson Davidson	Lowell
William Francis Dempsey	Lowell
Robert A. Dunstan	Billerica
George Pickering Edney	Lowell
Howard Wilmott Edwards	Lowell
Florand Joseph Gauthier	Lowell
Clement Alphonse Gendron	Lowell
Leighton Bernard Gendron	Lowell
John James Gillis	Lowell
Edward Chester Girard	North Andover
Donald Gordon	Lowell
Louis Joseph Greaves	Lowell
Michael John Grimolizzi	Lowell
John Joseph Hansbury	Lowell
Joseph Hines	Lawrence
Francis William Hogan	Lowell
William Franklin Huntley	Lowell
Ernest August Johnson	Nashua, N. H.
Walter Joseph Jurczak	Lawrence
Peter Kayros	Hudson, N. H.
Frederick Joseph Kelleher	Lawrence
Theodore Frank Koza	Lawrence

Palmer Adolfus Lacoss	Lowell
John Joseph Leary	Lowell
Henry Wilbrod Lemire	Lowell
Harry Elwin Livermore	Tyngsboro
Ray William Livermore	Nashua, N. H.
Donald McKeown	North Billerica
Francis Homer McMorrow	Lowell
Edward Daniel Markham	Lowell
Henry Homer Martell	Lowell
Ernest Henry Martin	Lowell
Philip Butler Midgley	Lowell
Bernard Miller	Lowell
Charles William Miller	Lowell
William Blair Mochrie	Lowell
Andrew Reese Molloy	Lowell
Octave Abraham Montminy	Lowell
Arthur Joseph Moreau	Lowell
Armand Gerard Morin	Lowell
John Francis Moynihan	Lawrence
Joseph Richard Mozykowski	Lowell
Edward Felix Padonevitch	Lowell
Clifton Alden Perry	Dracut
Walter Cecil Perry	Medford Hillside
Henry Charles Pilawski	Lowell
Francis David Plunkett	Lowell
Martial Bernard Racette	Lowell
Henry George Robert	Lowell
Fred Haywood Robertson	Lowell
Joseph Harry Rushton	Methuen
Chester Edward Ruston	North Billerica
Joseph John Sagaties	Lowell
Gilbert Settle	Methuen
Edward Silva	Lowell
Andrew Jacob Slobodnik	Lawrence
Harold Arthur William Stacy	Lawrence
Ernest George Sullivan	Lowell
Douglas Ross Thomson	Lowell
Walter Edmond Traversy	Lowell
Earle Wesley True	North Billerica
James Phillip Tully	Lowell
Dore Earle Tyler	Lowell
James Michael Wallace	Lawrence
Edward Augustin Wood	Methuen
Rudolph Joseph Zygadlo	Lowell

Selling and Advertising—1 Year.

William Joseph Ahearn	Lowell
Nicholas Antifonario	Lowell
Mary Elizabeth Carney	Lowell
Arthur Compagnone	Lawrence
Frank Parker Conrad	Wilton, N. H.
Alfred Louis Dion	Lowell
Joseph Timothy Duggan	Lowell
Louis Costas Georgekakos	Lowell
Harold Charles Giffin	Lowell
Joseph Hanley	Bradford
Joseph James Higgins	Lowell
George Demeritt Kenniston	Lowell
John Nicholas Koumoutseas	Lowell
Raymond Anthony Laponsie	Wilton, N. H.
Raymond Gerard Larkin	Lowell
Joseph Henry Mellen	Lowell
Ralph Vincent Naples	Nashua, N. H.
Thomas Clifford Nelson	Lowell
Herbert Alexander Semple	Lawrence
Thomas Francis Sheehan	Lowell
Frank Anthony Siegler	Lawrence
Samuel Shattuck Spence	Nashua, N. H.
Malcolm Swain Stevens	Lowell
Edward William Tamulonis	Lowell
William Rogers Walsh	Lowell

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AN INVESTIGATION OF THE POSSIBILITY OF QUANTITATIVE MEASUREMENT OF THE FASHION CYCLE

By Charles F. Edlund, S. B., Ed. M.,
Instructor in Sales Engineering

The following paper is a joint summary of three theses performed under the direction of the Textile Engineering Department by Arthur S. Freeman, J. Raymond Kaiser, and Sidney Boordetsky. These theses were a partial requirement for the degree of Bachelor of Textile Engineering.

THEORY

In the constant changes of fashion, there is a definite sequence of rise, culmination and decline. When the mass acceptance, i.e., sales, of any fashion is plotted against time, a curve results which may be called the fashion cycle. It measures quantitatively the rise and fall of the fashion in question. This fashion cycle was originally investigated by Paul H. Nystrom, Professor of Marketing at Columbia University, and reported in his book "Economics of Fashion." He assumed it to be a symmetrical bell-shaped curve. His evidence was based on an analysis of fashions illustrated in the back numbers of fashion magazines for a few items only, notably the length of women's skirts.

OBJECT

The present investigation was undertaken for the purpose of determining:

(A) If the curve of the fashion cycle as determined by Mr. Nystrom is correct.

(B) If some other curve is a better approximation.

(C) If there is a different curve for different items of fashion.

(D) If any definite fashion cycle exists at all, i.e., whether or not the variations in the rise and fall of successive fashions, when plotted against time, are so great as to preclude the possibility of any uniform conclusion as to the general shape of the curve.

Due to the limitation of time, these first three studies presented by Sales Option students consisted essentially of a preliminary investigation of the field to determine the proper approach to the subject and the existence and availability of records dealing with fashion sales.

PROCEDURE

Three possible approaches to the subject were investigated.

1. Investigation by a study of retail store records. By selecting a specific item or items it might be possible to measure quantitatively its rise and fall in consumer acceptance through the medium of retail sales records in a group of representative stores.

2. Investigation by a study of manufacturers' sales. By studying the sales records of manufacturers on specific items over a period of time, an accurate cycle might be obtained.

3. Nystrom's method of fashion magazines. Counting the frequency with which a given item appears from month to month, might give a measurement of the fashion's acceptance, rise and decline.

The possibility of actually counting, by means of statistical samples, the growth of a fashion amongst consumers was discarded as impractical for the resources of the school and students.

Mr. Freeman's investigation dealt largely with the third approach, that of fashion magazines. He also covered in a partial manner the possibility of retail store records as a source of fashion cycle measurement.

Mr. Kaiser's thesis covered retail records for women's wear items, both as to cut and to color, as a possible source of data.

Mr. Boordetsky investigated the records of men's wear, especially shirtings, kept by retailers, cutters-up, wholesalers, mills, selling agents and converters.

The method of investigation used was largely interviews with the proper executives in firms located in Lowell, Boston and New York. In addition, a number of firms were contacted by means of questionnaires.

Mr. Boordetsky contacted over 44 firms from mills to retailers in gathering data for his report. Mr. Kaiser conducted over 24 interviews with retailers in Lowell, Boston and New York, and Mr. Freeman conducted 3 in Boston. Mr. Freeman also investigated the back copies of Harper's Bazaar from 1930 to 1934 in an effort to measure by Nystrom's methods the fashion cycle in evening gowns. Over 627 evening gowns were classified as to period influence and the various period influences predominant in the gowns graphed as to monthly variations over the period in question.

CONCLUSIONS

1. An analysis of the fashion cycle by means of fashion magazines is inadequate for the purposes desired, because of the emphasis of the fashion magazines on the unusual style as well as many new styles which never become fashions, rather than on those styles selling in volume, i.e., fashions.

The difficulty of classification of styles illustrated in magazines make this source inadequate, in any case, except for the most basic and general trends, such as skirt lengths.

2. It is not possible to obtain a quantitative measurement of the fashion cycle through the medium of retail store records either in men's wear or women's wear. These records are kept from a merchandising rather than a fashion point of view.

In women's wear, retail records as to color, pattern and dress cut are grouped together in such broad basic classifications as to be worthless for a study of the desired type.

In men's wear with the exception of men's suitings, retail records were found to be of a similar nature.

3. A sufficient number of garment manufacturers in men's wear lines keep adequate records so that an analysis, at this level of distribution, of the fashion cycle may be possible. The records of garment manufacturers in women's wear have not yet been covered in the study.

4. The opinion of qualified people in all lines is divided as to the existence of a regualr fashion cycle. Those associated with retailing, in general, believe that fashion is purely haphazard in its operation. Those associated with manufacturing believe, in general, that fashion behaves in a statistical and logical manner capable of being quantitatively measured in line with the present study.

With the limited amount of time and money available, it is hoped to carry on this work still further until the existence of a regular fashion cycle is proved or disproved and, if it exists, its shape determined. The value of such a cycle to retailers and manufacturers alike, if it could be quantitatively determined, would of course be very great.

Southwick Hall

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CALENDAR

1937–1938

September 9–10, Thursday–Friday . . .	Entrance Examinations
September 13–18, Monday–Saturday . . .	Re-examinations
September 16, Thursday, 9.00 A.M.	Registration for Freshmen
September 20, Monday	Registration for upper-class students Classes begin for Freshmen
September 21, Tuesday	Classes begin for upper-class students
October 12, Tuesday	Columbus Day — Holiday
November 11, Thursday	Armistice Day — Holiday
November 23, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 29. Monday, 9.00 A.M.	Thanksgiving recess ends
December 17, Friday, 4.45 P.M.	Christmas recess begins
January 3, Monday, 9.00 A.M.	Christmas recess ends
January 17, Monday	First term examinations begin
January 28, Friday	End of first term
January 31, Monday	Second term begins
February 22, Tuesday	Washington's Birthday — Holiday
April 13, Wednesday, 4.45 P.M.	Spring recess begins
April 20, Thursday, 9.00 A.M.	Spring recess ends
May 23, Monday	Second-term examniations begin
May 30, Monday	Memorial Day — Holiday
June 7, Tuesday	Commencement
June 9–10, Thursday–Friday	Entrance Examinations

1938–1939

September 8–9, Thursday–Friday	Entrance Examinations
September 12–17, Monday–Saturday . . .	Re-examinations
September 15, Thursday, 9.00 A.M.	Registration for Freshmen
September 19, Monday	Registration for upper-class students Classes begin for Freshmen
September 20, Tuesday	Classes begin for upper-class students
October 12, Wednesday	Columbus Day — Holiday
November 11, Friday	Armistice Day — Holiday
November 22, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 28, Monday, 9.00 A.M.	Thanksgiving recess ends
December 21, Wednesday, 4.45 P.M. . . .	Christmas recess begins
January 4, Wednesday, 9.00 A.M.	Christmas recess ends
January 16, Monday	First term examinations begin
January 27, Friday	End of first term
January 30, Monday	Second term begins
February 22, Wednesday	Washington's Birthday — Holiday
March 31, Friday, 4.45 P.M.	Spring recess begins
April 10, Monday, 9.00 A.M.	Spring recess ends
April 19, Wednesday	Patriots' Day — Holiday
May 22, Monday	Second term examinations begin
May 30, Tuesday	Memorial Day — Holiday
June 6, Tuesday	Commencement
June 8–9, Thursday–Friday	Entrance Examinations

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Clerk

HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had charge of the work of construction. The building of one story in height completed the fourth side of the quadrangle and in outward appearance corresponds to the architectural features of the other school buildings. At the present time the construction of three additional stories is in progress and at its dedication will be called The Louis Pasteur Hall.

In addition to the class rooms and laboratories of the Wool Yarns, Cotton Finishing, and Chemistry and Dyeing Departments now in this building it will provide three floors to be used by the Chemistry and Dyeing Department.

The buildings are of modern mill construction adapted to educational uses and contain approximately 181,294 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Bcard or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	12

Elective Subjects

	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	10

Elective Subjects

Four may be selected from the list under Degree Courses.

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 9, 1938; Thursday, September 8, 1938; Thursday, June 8, 1939:—
- Algebra, 9 A.M. to 11 A.M.
- History, 11 A.M. to 1 P.M.
- English, 2 P.M. to 4 P.M.

Friday, June 10, 1938; Friday, September 9, 1938; Friday, June 9, 1939:—
- Plane Geometry, 9 A.M. to 11 A.M.
- German or French, 11 A.M. to 1 P.M.
- Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry and textile manufacturing have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students shall be the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential

subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 15, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

CHANGE IN TUITION RATES

The following rates will apply for new students entering the Institute for the school year beginning September 1938 unless changed by vote of the Board of Trustees:

Residents of Massachusetts	$150 per year
Residents of United States outside of Massachusetts	$250 per year
Citizens of Foreign Countries	~~$400~~ per year
	$ 500.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a

statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—All students not taking chemistry are required to make a deposit of $10 each year to cover general breakage, the unexpended balance to be returned at the end of the year to students not otherwise in arrears.

First year students taking Chemistry are required to make a deposit of $25. Second, third and fourth year chemistry students are required to make a deposit of $25 each term. The unexpended balance will be returned at the end of the year to students not otherwise in arrears.

All deposits must be made before students can be admitted to laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop.)	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Section of the American Society of Dyers and Colorists hold meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store.—A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1937–38

E. Dean Walen, '14, *President*
Russell T. Fisher, '14, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*
A. Edwin Wells, '20, *Assistant Secretary*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06
Alexander Campbell, '23
James F. Dewey, '04
Parker F. Dunlap, '34
Russell T. Fisher, '14
Olin D. Gay, '08
Thomas Joy, '26
Harry W. Martin, '11
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Henry S. Sawyer, '32
Dean W. Symmes, '22
J. Milton Washburn, Jr., '21

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term

(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

FIRST YEAR. SECOND TERM. (HOURS OF EXERCISE)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

SECOND YEAR. FIRST TERM

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

SECOND YEAR. SECOND TERM

Cotton Yarn Manufacture F-20	225	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

THIRD YEAR. FIRST TERM

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

THIRD YEAR. SECOND TERM

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C-20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Knitting F–31	105	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a	30	Worsted Yarn Manufacture G–30	165
Power Weaving D–32	90		

Third Year. Second Term

Power Weaving D–32	150	Worsted Yarn Manufacture G–30	300
Woolen and Worsted Finishing H–30	75	Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–11a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Cotton Yarn Manufacture F–20a	90
Color and Dynamic Symmetry D–33	30
Physics B–23a	45
Power Weaving D–24	90
Steam Engineering B–24	30
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20–21	90
Jacquard Design D–23	45
Physics B–23a	45
Power Weaving D–24	120
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	135

Third Year. First Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Power Weaving D–32	60
Textile Design and Cloth Construction D–30	105
Textile Testing G–31	30
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30.	90

Third Year. Second Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Jacquard Design D–31	75
Power Weaving D–32	105
Textile Design and Cloth Construction D–30	75
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30.	60
Thesis.	

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Adv. Organic Chemistry C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–23	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Adv. Organic Chemistry C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15	Economics E–30	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
		Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90	Organic Laboratory C–36	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Electives or Thesis C–52	90
Chemical Textile Testing C–43	45	Organic Laboratory C–41	75
Colloid Chemistry C–50	30	Quantitative Analysis C–46	15
Industrial Chemistry C-42	30	Report Writing C–47	15
		Technical German C–40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Organic Laboratory C–41	105
Adv. Textile Chemistry and Dyeing Lab. C–44	120	Rayon Manufacturing C–51	30
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Seminar in Business English E–40	15
Chemical Textile Testing C–43	45	Technical German C–40	30
Electives or Thesis C–52	90	Technology of Wool Manufacture Fibers G-40	15
		Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has lead to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General, Design and Sales Options some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Machine Drawing B–21	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	60
Mill Engineering B–45	67	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

THIRD YEAR. SECOND TERM

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	45
Mill Engineering B–45	30	Thesis	97

FOURTH YEAR. SECOND TERM

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B–21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	68	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	127

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Power Weaving D–24	105
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60	Textile Design and Cloth Construction D–20, 21	105
Physics B–23	75		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		

Third Year. Second Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	75
Cotton Yarn Manufacture F–30a	75	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D-41	90	Textile Testing B-43	60
Textile Marketing B–42	30	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Textile Design and Cloth Construction D-41	90
Cotton Finishing H–31	105	Thesis	135
Jacquard Design and Weaving D-40	105		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	105
Textile Chemistry and Dyeing Lect. C-20	30
Textile Design and Cloth Construction D–20, 21	105

Third Year. First Term

Color and Dynamic Symmetry D–33	30
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Power Weaving D–32	75
Principles of Marketing B–35	45
Textile Design and Cloth Construction D–30	105
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Color and Dynamic Symmetry D–33	30
Cotton Yarn Manufacture F–30a	75
Economics E–30	45
Marketing Methods B–36	60
Power Weaving D-32	30
Statistics	45
Textile Design and Cloth Construction D–30	75
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	90
Principles of Selling and Advertising B–49	105
Selling Policies B–52	45
Textile Design and Cloth Construction D-41	60
Textile Microscopy B–41	45
Textile Styling B–50	30
Textile Testing B–43	60
Thesis	90

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Foreign Trade and Economic Geography B–51	45
Jacquard Design and Weaving D–40	30
Knitting F–31	75
Selling Policies B–52	45
Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B–10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B–11. Preparation: Admission Requirements. Taken simultaneously with B–10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B–12. Preparation: B–10 and B–11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.[

Mechanical Drawing—B–13. Preparation: Admission Requirements. Taken simultaneously with B–11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B–13a. Preparation: Admission Requirements. Taken simultaneously with B–11. This course is similar to B–13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B–20. Preparation: B–10. This subject is a continuation of the first year subject B–10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B-20a. Preparation: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B-21. Preparation: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

LABORATORY. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B-23a. Preparation: B-10 and B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B-24. Preparation: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B-25. Preparation: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B-26. Preparation: B-11 and B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B–30. Preparation: B–25. This is a continuation of Applied Mechanics B–25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B–31. Preparation: B–23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B–31a. Preparation: B–23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B–32. Preparation: B–12, B–20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B–33. Preparation: B–32. This course is a continuation of B–32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates. with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B–34. Preparation: B–21, B–25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B–34a. Preparation: B–21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B–34. [Courses I, II.]

Principles of Marketing—B–35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B–36. Preparation: B–35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B–40. Preparation: B–10 and E–30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B–41. Preparation: B–23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparations: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C–10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C-20. [All courses.]

Qualitative Analysis—C-11. Preparation: C-10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C-10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C-11a. Preparation: C-10, taken simultaneously. This course is similar to C-11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C-12. Preparation: C-10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C-20. Preparation: C-10, B-12, B-13a. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents,

developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

Bleaching processes applicable to various animal and vegetable fibres are studied.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C–22. Preparation: C–10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time

will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dyestuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C–23. Preparation: C–11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

Stoichiometry—C–24. Preparation: B–10, C–10, C–12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C–30. Preparation: C–23. The fundamental principles acquired in Course C–23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Griffin's "Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C–31. Preparation: C–22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's "Industrial Chemistry," Third Edition. Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–32. Preparation: C–20, C–21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.—Ash, ash alkalinity, weighting, copper and manganese, acids and bases, sizing, oils, waxes, greases, soaps, fiber blends, baryta absorption, solubility in caustic, Methylene Blue absorption, copper number, fluidity in cuprammonia, nitrogen by Kjeldahl, sulfur by Benedict-Davis, ammonia nitrogen, Pauly test, solubility of wool in sodium hydroxide, viscosity of silk.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C-48. Preparation: C-47. This object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-11, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C-50. Preparation: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C-51. Preparation: C-32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Elective Subjects or Thesis during fourth year—C-52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several electives were introduced, each elective period being 45 hours per term and four of these being required during the year.

Thesis. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is suually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Jacquard Design—D–31. This is a continuation of Jacquard Design D–23. [Course III.]

Power Weaving—D–32. Preparation: D–20, D–21, or D–23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Color and Dynamic Symmetry—D–33. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D–40. Preparation: D–23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D–41. Preparation: D–10, D–20, D–21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E–10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric

and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E–11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E–20. Preparation: E–10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E–21. Preparation: E–11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E–30. Preparation: E–10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E–40. Preparation: E–10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F–20. Preparation: B–10, B–12, B–13. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F-20a. Preparation: B-10, B-12, B-13. This course is similar to Course F-20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-25. Preparation: B-12, D-10. This course covers the same lectures and laboratory work as F-31. [Course VI, Option G.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F–31a. Preparation: B–12, D–10. This course embraces the same lectures as Course F–31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F–32. Preparation: F–20 or F–20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F–35. Preparation: F–25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F–34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W,D,S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced

on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G–31. Preparation: B–23, F–30 or G–30, D–24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G–40. Preparation: C–21, C–32, D–10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H–30. Preparation: B–12, C–10, D–10, D–24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the

method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

FULLING.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

WASHING AND SPECK DYEING.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

CARBONIZING.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

GIGGING, NAPPING, STEAMING, SINGEING AND CRABBING.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

BRUSHING, SHEARING AND PRESSING.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders

of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts. above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders complete.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam -driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company; single yarn and fabric strength-testing machines made by G. R. Smith & Company; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company, a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company. The Whitin Machine Company has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8 spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company.

The Weaving Department contains four looms supplied by the Draper Corporation, which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company. The Hopedale Manufacturing Company installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one

Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift. double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table. The Balance Room has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with fifty-six steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine; a set of drying cans; a chain dyeing machine; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydro-extractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 8, 1937

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Chemistry and Textile Coloring, no thesis subjects have been listed.

Gustave Warren Hakanson	Winchester, Mass.
Lee Gale Johnston	Haverhill, Mass.
Charles Ernest Lincoln	Mattapan, Mass.
Robert Keith Lyle	Lowell, Mass.
Charles Megas	Lowell, Mass.
Basil Andrew Natsios	Lowell, Mass.
Francis Xavier Nerney	Dracut, Mass.
Paul William Regan	Lowell, Mass.
James Peter Spanos	Lowell, Mass.
Socrates Vasilios Vaniotis	Lowell, Mass.
Herbert William Wilkinson, Jr.	Thompson, Conn.

Master of Science in Textile Engineering

Marian Brownson Calder, Dallas, Texas. B.S. 1934 Texas State College for Women. "A comparison of two methods of measuring the thermal conductivity of fabrics."

Harold Mills Manderbach, Lowell, Mass. B.A. 1924 University of Michigan. "An investigation of the relation between the number of tests and the mean breaking strength of a two-ply worsted yarn."

Bachelor of Textile Engineering

Louis Loss Bassett, Lowell, Mass. "A study of the use of arbitration in commercial disputes in the textile industry."

Sidney Morris Boordetsky, Cambridge, Mass. "An investigation of the possibility of quantitative measurements of the fashion cycle in men's shirtings."

William James Daly, Andover, Mass. "The construction and calibration of an improved Walen-Parsons evenness tester."

Thomas Nathan Fisher, Lowell, Mass. "A comparison of two methods of measuring the air permeability of fabrics."

Harold Ernest Reed, Nashua, N. H. "Conditioning boxes."

Lucy Wiley Robbins, Lowell, Mass. "A study of color measurements of silk fabrics."

Harvey Chih Sung, Tientsin, China. "A determination of the relation between the strength and twist of two-ply worsted yarns."

Diploma in Wool Manufacture

Leon Stearns Gay, Jr., Lowell, Mass. "The manufacture of a woolen flannel suiting from scoured and frosted wools."

Prizes awarded in June, 1937

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *Louis Loss Bassett.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Gustave Warren Hakanson.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Herbert Charles Olsen.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *William Benjamin Prescott.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Arthur Sabin Davis.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Arthur William Lanner.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Acar, Ibrahim Zeki, VI, Istanbul, Turkey B. Sc. Tech., University of Manchester, 1936	52 Mt. Washington Street
Bethel, Ion Maywood, VI, Philadelphia, Pa. B.S., Texas Agricultural & Mechanical College, 1925	250 Nesmith Street
Lizak, Boleck Louis, IV, Chicago, Ill. B.S., Lewis Institute, 1937	43 Plymouth Street
Parechanian, James Humphrey, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1935	1 Summer Court
Prien, Walter Ferdinand, VI, Milwaukee, Wis. B.S., U. S. Naval Academy, 1930	235 Princeton Boulevard
Robbins, Lucy Wiley, VI, Lowell, Mass. B.T.E., Lowell Textile Institute, 1937	102 South Loring Street
Steadman, Frank M., VI, Indianapolis, Ind. B.S., U. S. Military Academy, 1929	22 Fairgrove Avenue

Undergraduate Students
Candidates for Degree

Class of 1938

Broadhurst, Russell Denton, IV, Middletown, Conn.	50 Standish Street
Buckley, Herman Timothy, IV, East Chelmsford, Mass.	———
Carroll, Hugh Francis, IV, Medford, Mass.	———
Fleming, John Harvey, VI, Sanford, Me.	Omicron Pi House
Fox, Kenneth Russell, VI, Lowell, Mass.	359 Beacon Street
Freedman, David, VI, Boston, Mass.	1280 Middlesex Street
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Garcia, Lorenzo Montero, VI, Mexico D. F., Mexico	337 Beacon Street
Getchell, Nelson Fletcher, IV, Lowell, Mass.	75 Pine Street
Grossman, Clinton, IV, Providence, R. I.	1280 Middlesex Street
Hardy, Thomas Wadsworth, IV, Lowell, Mass.	30 Chauncey Avenue
Harpoot, Burgess Charles, VI, Lowell, Mass.	185 Liberty Street
Howard, Winfield Hersey, IV, North Chelmsford, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kaplan, Samuel Gilbert, IV, Lowell, Mass.	472 Wilder Street
Kelakos, Charles George, VI, Lowell, Mass.	6 Rockdale Avenue
Kelly, Warren Thomas, VI, Lowell, Mass.	41 E Street
Kennedy, Robert Miller, VI, Dunstable, Mass.	———
Klosowicz, Edward Joseph, VI, Lowell, Mass.	40 Read Street
Knight, Richard Greene Howland, Jr., VI, Fall River, Mass.	50 Standish Street
Lemieux, Robert Alphonse, IV, Lowell, Mass.	56 Third Avenue
Littlefield, Carl Richard, VI, Lowell, Mass.	69 Warwick Street
Lutz, Helmuth Erich, IV, Lowell, Mass.	7 Houghton Street
McMahon, Martin Edward, IV, Lowell, Mass.	43 London Street
Mahoney, Joseph Healey, IV, Andover, Mass.	———
Olsen, Earl Edward, VI, Reading, Mass.	———
Paige, Walter Hale, Jr., VI, New Bedford, Mass.	Omicron Pi House
Ploubides, John Peter, IV, Lowell, Mass.	59 Varney Street
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Reddish, Charles Warren, IV, Cincinnati, Ohio	548 Fletcher Street
Shapiro, Sidney, VI, Lowell, Mass.	134 Bellevue Street

Home Address	*Lowell Address*
Sheehan, Leo James, IV, Dracut, Mass.	———
Sood, George David, IV, Woonsocket, R. I.	793 Merrimack Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlboro Street
Wright, George Ward, Jr., IV, Newtonville, Mass.	Omicron Pi House

Class of 1939

Baker, Phyllis Jeanne, VI, Concord, Mass.	Dalton Road, Chelmsford
Banta, John Garret, VI, Grantwood, N. J.	Phi Psi House
Beauregard, Albert Joseph, VI, Lowell, Mass.	258 Varnum Avenue
Bone, Arthur P. Stuart, VI, Lowell, Mass.	Phi Psi House
Brantman, Jackson Agmor, VI, New York, N. Y.	Phi Psi House
Colby, Vernon Warren, IV, Haverhill, Mass.	———
Comins, Richard Coolidge, VI, Ballardvale, Mass.	———
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Derzawetz, Joseph, VI, Boston, Mass.	———
Dick, Henry Kendal, Jr., VI, Bloomfield, N. J.	75 Fourth Avenue
Dori, Anita Marie, VI, Chester, Mass.	137 Riverside Street
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Gianaris, George Demetrios, VI, Lowell, Mass.	678 Lakeview Avenue
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Greene, John Lester, VI, Lowell, Mass.	388 East Merrimack Street
Jarek, Helen Jane, IV, Lowell, Mass.	74 Eleventh Street
Levin, Samuel, IV, Lowell, Mass.	43 Ware Street
Lyons, James Francis, Jr., IV, Nashua, N. H.	———
Marsden, Sidney Robert, IV, Lawrence, Mass.	Phi Psi House
Miller, Arnold Irving, IV, Lowell, Mass.	268 Shaw Street
Monahan, Harold Joseph, IV, Dorchester, Mass.	———
Murphy, Hubert James, IV, North Chelmsford, Mass.	———
O'Donoghue, Eileen Margaret, VI, Lowell, Mass.	20 Columbia Street
Oliver, Roger Barton, VI, Lowell, Mass.	62 Glenwood Street
Olsen, Herbert Charles, IV, Reading, Mass.	———
Page, Herbert Stanton, IV, Chelmsford, Mass.	———
Patsourakos, James Peter, IV, Lowell, Mass.	619 Market Street
Prescott, William Benjamin, IV, Westford, Mass.	———
Reddish, Thomas Warren, IV, Cincinnati, Ohio	Phi Psi House
Reed, Everett Carlton, VI, Chelmsford, Mass.	———
Reed, William Thorncroft, VI, Lowell, Mass.	617 Westford Street
Ritchie, Newell Baird, IV, Concord, N. H.	———
Roth, Paul, VI, Brooklyn, N. Y.	43 Plymouth Street
Rowntree, Clyde Burton, IV, Lowell, Mass.	32 Lane Street
Spevack, Edward, IV, Carlstadt, N. J.	1280 Middlesex Street
Steinberg, Sidney, VI, Brooklyn, N. Y.	1280 Middlesex Street
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Winkler, Burton Cole, IV, Elizabeth, N. J.	Phi Psi House

Class of 1940

Aigen, Lawrence, VI, Brooklyn, N. Y.	43 Plymouth Street
Balas, Fred Frank, VI, Lowell, Mass.	196 Mt. Pleasant Street
Beltramini, Kenneth Charles, VI, West Englewood, N. J.	Phi Psi House
Brooks, Raymond King, VI, Unionville, Conn.	Omicron Pi House
Bullock, Merlen Clarke, VI, Lowell, Mass.	38 Burtt Street
Campbell, Andrew Morris, IV, Lawrence, Mass.	———
Chapman, Boyd Palmer, Jr., IV, Franklin, Mass.	Omicron Pi House
Cherr, Alda Jay, VI, New York, N. Y.	32 Mt. Washington Street
Chisholm, Kenneth, Jr., IV, Medford, Mass.	———
Davis, Arthur Sabin, IV, Lowell, Mass.	105 Inland Street

Home Address	*Lowell Address*
Esielionis, Victor John, VI, Shirley, Mass.	———
Falk, Stanley, VI, Brooklyn, N. Y.	123 Riverside Street
Feuerstein, James Mayer, VI, Jamaica Plain, Mass.	84 Gates Street
Fox, Louise, VI, Dracut, Mass.	———
Gill, John Schofield, IV, Andover, Mass.	———
Grothe, David Ivan, VI, Laconia, N. H.	137 Riverside Street
Haas, Alexander Robert, VI, Brooklyn, N. Y.	43 Plymouth Street
Hall, Richard Thomas, IV, Lowell, Mass.	54 Seventh Street
Hull, Robert Barney, VI, Lowell, Mass.	606 Stevens Street
Jones, Newton Adelbert, IV, Melrose, Mass.	———
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Kiernan, James Vincent, VI, Dracut, Mass.	———
Lanner, Arthur Williams, IV, North Tewksbury, Mass.	———
Lynch, Edward Mark, IV, Lawrence, Mass.	———
McGilly, John Seede, VI, Lowell, Mass.	16 Talbot Street
Manning, Neil Joseph, IV, Lowell, Mass.	118 Mt. Washington Street
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street
Meuser, Rudolph Walter, VI, Pawtucket, R. I.	Omicron Pi House
Nelson, William Arthur, IV, Lowell, Mass.	896 Westford Street
Nuttall, Andrew Frederick, IV, North Billerica, Mass.	———
Ocoma, Estanislao Manaois, B.S., VI, Boston, Mass.	768 Merrimack Street
Pelt, Joseph, Jr., VI, South Orange, N. J.	Phi Psi House
Pero, Henry Leland, VI, West Willington, Conn.	Omicron Pi House
Rovner, Albert Hyman, VI, Chelsea, Mass.	———
Silberstein, Raymond, VI, Brooklyn, N. Y.	266 Gibson Street
Silverman, Joseph Melvin, VI, Winthrop, Mass.	1280 Middlesex Street
Sweatt, Safford Pershing, IV, Lowell, Mass.	124 Stevens Street
Taylor, Roy Arnold, Jr., IV, West Newton, Mass.	———
Thayer, Walter Stephen, VI, New Ipswich, N. H.	337 Beacon Street
Tuttle, Kendall Chapin, VI, Groton, Mass.	———
Upton, George Joseph, IV, Fitchburg, Mass.	———
Wolf, Irving Jacob, VI, Lowell, Mass.	218 Gibson Street
Woodard, Malcolm Russell, IV, Chelmsford, Mass.	———
Zarules, George, IV, Peabody, Mass.	48 Claire Street

Class of 1941

Adie, Donald Miles, VI, Lowell, Mass.	26 Otis Street
Alexander, Gerard, VI, Kew Gardens, L. I., N. Y.	43 Plymouth Street
Atwell, Ralph Gilmore, VI, Dracut, Mass.	———
Bardzik, Thaddeus, IV, Dracut, Mass.	———
Batcheller, Ben Pitman, IV, Andover, Mass.	———
Biron, Joan Marguerite, VI, Lowell, Mass.	56 Fairlawn Street
Brown, Needham Ballou, Jr., VI, Andover, Mass.	———
Buzidragis, Joseph Francis, IV, Lowell, Mass.	93 Davidson Street
Campbell, John Duncan, VI, South Boston, Mass.	37 Varney Street
Caraganis, Nicholas Lewis, VI, Dracut, Mass.	———
Carmichael, Robert Dana, VI, Andover, Mass.	———
Casavant, Kenneth Arthur, IV, Gardner, Mass.	66 Riverside Street
Condon, John Andrew, Jr., IV, North Billerica, Mass.	———
Cordeau, George Edward, IV, Lowell, Mass.	1014 Lakeview Avenue
Curtin, Thomas Emmet, IV, Lowell, Mass.	49 Second Street
Demitropoulos, Andrew Peter, VI, Dracut, Mass.	———
Dubrule, Louis Joseph, IV, Lawrence, Mass.	———
Epstein, Edward Joseph, IV, Newark, N. J.	137 Riverside Street
Finard, Saunder, IV, Revere, Mass.	242 Hildreth Street

Home Address	*Lowell Address*
Finn, Charles Anthony, IV, Milton, Mass.	Phi Psi House
Flood, Edward Robert, IV, Lowell, Mass.	118 Bartlett Street
Fortier, George Charles, IV, Dracut, Mass.	———
Gari, Jose Via, VI, Mexico City, Mexico	9 White Street
Garnett, Stanley Arthur, IV, Edgewood, R. I.	137 Riverside Street
Garrity, Edward Leo, IV, Lowell, Mass.	366 Parker Street
Gass, Matthew, IV, Lowell, Mass.	201 Hildreth Street
Gatzimos, Aristophanes, IV, Lowell, Mass.	17 Little Street
Ginivan, William Francis, IV, Lowell, Mass.	50 Lamb Street
Greenbaum, Bernard Saul, IV, Haverhill, Mass.	———
Grondin, Abraham Hector, IV, Lowell, Mass.	111 Alma Street
Guilfoyle, Donald William, VI, Providence, R. I.	337 Beacon Street
Halaby, William Edwin, VI, Medellin, Colombia, S. A.	15 Douglas Road
Hamilton, Arthur Theodore, VI, Pittsfield, Me.	337 Beacon Street
Higginbottom, George Stephen, IV, Lowell, Mass.	46 Otis Street
Inkpen, Norman Alfred, IV, Ward Hill, Mass.	———
James, Ernest Peter, IV, Haverhill, Mass.	———
Jay, Joshua Daniel, VI, Brooklyn, N. Y.	142 Riverside Street
Joyce, Herbert Milton, VI, Mountain Side, N. J.	43 Plymouth Street
Keizer, Miriam Eileen, IV, Westford, Mass.	———
Kennedy, John Francis, IV, Lowell, Mass.	20 Bertha Street
Koulas, Stanley Charles, IV, Chelmsford, Mass.	———
Landfield, Harold, IV, Dorchester, Mass.	445 High Street
Lane, Joseph James, VI, Webster, Mass.	337 Beacon Street
Lannon, John Francis, Jr., IV, Saylesville, R. I.	53 Mt. Hope Street
Leary, Gordon Simpson, IV, Lowell, Mass.	834 Andover Street
Lewis, Dorothy Elaine, VI, Chelmsford, Mass.	———
Linden, Leo, VI, Chelsea, Mass.	———
McCaffrey, Joseph Fredrick, IV, Dracut, Mass.	———
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
McTeague, George David, IV, Lowell, Mass.	298 Riverside Street
Mahan, Frederick Joseph, IV, Lowell, Mass.	825 Chelmsford Street
Mahoney, Francis Vincent, Jr., North Billerica, Mass.	———
Mason, Frederick Rufus, VI, Glendale, R. I.	64 Orchard Street
Milberg, Maurice, VI, Bronx, N. Y.	75 Fourth Avenue
Mintz, Irving Paul, IV, Passaic, N. J.	137 Riverside Street
Molchan, Stanley Charles, VI, Lawrence, Mass.	———
Morse, Arthur George, VI, East Woodstock, Conn.	137 Riverside Street
Murphy, Francis Arthur, IV, Brookline, Mass.	———
Noonan, Arthur Thomas, IV, Dorchester, Mass.	———
Okun, Seymour, VI, Brooklyn, N. Y.	337 Beacon Street
Paley, Herbert Melvin, IV, Haverhill, Mass.	———
Patrick, Stephen Edmund, Jr., VI, Augusta, Me.	343 Wilder Street
Pernick, David, VI, New York, N. Y.	142 Riverside Street
Phillips, Maurice Gordon, VI, Southbridge, Mass.	337 Beacon Street
Platt, Walter Wallace, IV, Lawrence, Mass.	———
Portilla, Jose Luis, VI, Mexico, D. F., Mexico	9 White Street
Puliafico, Salvatore Joseph, IV, Barre Plains, Mass.	59 Crescent Street
Rashkin, Bernard, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Rich, Charlotte Merline, IV, Haverhill, Mass.	———
Roberts, Angus Henry, IV, Lowell, Mass.	35 Wiggin Street
Roberts, Gerald Adrien, IV, Millbury, Mass.	20 Crawford Street
Roux, Frank George, IV, New York, N. Y.	Phi Psi House
Sakelaris, Dionysius John, IV, Lowell, Mass.	78 Varney Street
Saltsman, Sidney Irving, IV, Lowell, Mass.	89 Washington Street

Home Address	*Lowell Address*
Scarmeas, Harry George, IV, Lowell, Mass.	21 Hancock Avenue
Schwartzmann, Moises, IV, Mexico D. F., Mexico	9 White Street
Shore, James Cooper, IV, Pawtucket, R. I.	359 Beacon Street
Siegler, Frank Anthony, VI, Methuen, Mass.	———
Skalkeas, Basil George, IV, Lowell, Mass.	53 Avon Street
Sullivan, Paul John, IV, Lowell, Mass.	33 South Walker Street
Szymosek, Frank John, IV, North Andover, Mass.	———
Tartikoff, Jordan Alvin, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Tattersall, James, VI, West Roxbury, Mass.	———
Urlaub, George Samuel, IV, Queens Village, N. Y.	43 Plymouth Street
Webb, Ralph Peabody, VI, Dracut, Mass.	———
Weil, Clarence Bernard, IV, New York, N. Y.	148 Riverside Street
Woodard, Alice Marjorie, VI, Chelmsford, Mass.	———
Zellweger, Ralph John, VI, Palisade, N. J.	53 Mt. Hope Street

Diploma Students

Class of 1938

Ekstrand, Frederic Lawrence, II, Stafford Springs, Conn.	Phi Psi House
Foss, George Woodrow, II, Haverhill, Mass.	———
Kane, Roger Hugh, II, Cherry Valley, Mass.	75 Fourth Avenue
Kareores, Gregory George, II, Lowell, Mass.	52 Lewis Street
LaBonte, Andrew Shea, II, Lawrence, Mass.	———
Lehto, Reino Gust, III, Maynard, Mass.	———
Pease, Kilburn Gray, I, Lowell, Mass.	337 Beacon Street

Class of 1939

Bauer, Frank Norbert, I, Waterloo, Ont.	226 Riverside Street
Cohen, Leonard Lee, II, Rochester, N. Y.	148 Riverside Street
Daun, Shin-Yuan, B.A., II, Wusih, Kiangsu, China	53 Mt. Hope Street
Gay, Clarence Russel, III, Lowell, Mass.	140 Methuen Street
Hackett, John James, II, Groton, Mass.	———
Hockmeyer, Clive Edward, Jr., I, Lowell, Mass.	7 Whitman Street
Li, Kwoh-Chang, B.A., II, Wusih, Kiangsu, China	53 Mt. Hope Street
Little, Ralph Harding, II, Rockville, Conn.	Omicron Pi House
Merritt, Charles Adelbert, II, Rockland, Me.	Omicron Pi House
Rees, Richard Holmes, I, Newtonville, Mass.	———
Scribner, James Woodbury, II, Manchester, N. H.	Omicron Pi House
Stowell, Eldon, A.B., I, Williamstown, Mass.	8 Mt. Washington Street
Wheelock, Silas Mandeville, Jr., II, Putnam, Conn.	Omicron Pi House
White, Robert Gordon, II, Worcester, Mass.	Phi Psi House
Wiesner, Arthur Charles, II, Lawrence, Mass.	———

Class of 1940

Baker, Ernest Paul, II, Auburn, Me.	1980 Middlesex Street
Finn, Joseph Francis, II, Milton, Mass.	Phi Psi House
Melinas, Lionel Aime, II, Woonsocket, R. I.	81 School Street
Hobson, Edward Shackford, I, Southbridge, Mass.	337 Beacon Street
Mackle, Chauncey Jacob, II, Cranston, R. I.	53 Mt. Hope Street
Moran, James Robert, II, Nashua, N. H.	———
Proulx, Arthur Anthony, II, Claremont, N. H.	65 Sterling Street
St. Jean, Lawrence Raymond, II, Harrisville, R. I.	226 Riverside Street
Snow, David Charles, II, Townshend, Vt.	43 Plymouth Street
Striar, Max Gordon, II, Bangor, Me.	1280 Middlesex Street
Worsfold, Jay Moody, II, Waltham, Mass.	———
Yacubian, Gamaliel Mardiros, II, Somerville, Mass.	———

Specials

	Home Address	*Lowell Address*
ALLAIRE, ALEXANDER HECTOR, IV, Woonsocket, R. I.		793 Merrimack Street
ARGERSINGER, CLARENCE DANIEL, II, Lowell, Mass.		Omicron Pi House
BRODSKY, WILLIAM, B.S., VI, New York, N. Y.		142 Riverside Street
CURRIER, ARTHUR MELVIN, I, Montclair, N. J.		Omicron Pi House
DIBBLE, CONDIT HUMPHREY, II, North Adams, Mass.		11 White Street
DUL, JOHN, III, Lawrence, Mass.		———
FLETCHER, JAMES RICHARD, III, Hamilton, Ont.		786 Merrimack Street
GOLDSTEIN, SEYMOUR, II, New York, N. Y.		100 Riverside Street
HALL, GEORGE TAIT, B.A., VI, Wilton, Conn.		137 Riverside Street
HARRINGTON, JOHN EDWARD, B.S., VI, Lawrence, Mass.		———
HASTINGS, ELIZABETH ASHLEY, III, South Yarmouth, Mass.		142 Princeton Street
HIRD, ARTHUR DEAN, VI, Lowell, Mass.		35 Burnaby Street
KARPOWICH, STANLEY, III, Methuen, Mass.		———
McCUSKER, THOMAS BERNARD, JR., A.B., III, East Braintree, Mass.		———
MALYN, THEODORE GREGORY, III, Lawrence, Mass.		———
MANTY, FREDERICK WILLIAM, III, Maynard, Mass.		———
MAXWELL, ELSIE GAGE, B.A., III, Butler, Pa.		115 Nesmith Street
MAXWELL, WILLIAM THOMAS, B.S., M.B.A., VI, Butler, Pa.		115 Nesmith Street
NAVAS, MATILDA MARCELLA, III, Lawrence, Mass.		———
O'CONNOR, JOHN TERRENCE, III, Woburn, Mass.		———
O'DONOGHUE, JOHN KEW, VI, Lowell, Mass.		84 Florence Avenue
PETERSON, ALBERT COBB, III, Rockland, Me.		Omicron Pi House
REED, GEORGE BLAKE, VI, Lowell, Mass.		617 Westford Street
RILEY, DAVID VINCENT, VI, Lowell, Mass.		591 Wilder Street
RUDNER, BERNARD, III, West Springfield, N. H.		———
SAFFORD, CHARLES LOUIS, A.B., VI, Lowell, Mass.		266 Andover Street
SCANLON, JOSEPH CORNELIUS, II, Lawrence, Mass.		———
SIMONEAU, WILFRED, III, Lawrence, Mass.		———
SLUSKI, JOHN SERGI, III, Maynard, Mass.		———
SPAULDING, EDWARD LEE, III, Billerica, Mass.		———
WEINTRAUB, PAUL LAWRENCE, JR., B.S., VI, Philadelphia, Pa.		343 Princeton Street
WESSELLS, JOSEPH FRANCIS, IV, Lowell, Mass.		31 England Street
WHITE, ROBERT HEDGES, B.S., VI, Medford, Mass.		———
WILKINSON, FREEMAN FIRTH, I, Thompson, Conn.		Omicron Pi House
ZALIS, JOHN HENRY, III, Canton, Mass.		———

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1938. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.

Abbott, George Richard, II, '08 (D). Andover, Mass.

Adams, Floyd Willington, VI, '16 (B.T.E.).

Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.

Adams, Tracy Addison, IV, '11 (D). Vice-President, Arnold Print Works, North Adams, Mass.

Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.

Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.), '36 (M.S.). With New England Telephone & Telegraph Co., Lawrence, Mass.

Allard, Edward Joseph, IV, '31 (B.T.C.). Salesman and Demonstrator, National Aniline & Chemical Company, Providence, R. I.

Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.

Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.

Anderson, Arthur Illman, IV, '24 (B.T.C.). Textile Chemist, Superintendent of Research, American Institute of Laundering, Joliet, Ill.

Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.

Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.

Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Forge Village, Mass.

Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.

Anthony, Henry Steere, Jr., IV, '36 (B.T.C.). Assistant Chemist, Tyer Rubber Company, Andover, Mass.

Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.

Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.

Arundale, Henry Barnes, II, '07 (D). Test and Research Engineer, Atwood Machine Company, Stonington, Conn.

Atwood, Henry Jones, II, '23 (D). Agent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.

Babigan, Edward, IV, '33 (B.T.C.). With Outlet Fruit Company, Lowell, Mass.

Babigan, Raymond, IV, '24 (B.T.C.). Associate Examiner, United States Patent Office, Washington, D. C.

Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.

Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study, Worsted Division, Pacific Mills, Lawrence, Mass.

Bailey, Lester Harold, IV, '24 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.

Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.

Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.

Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.

Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). President, Federal Clothing Manufacturing Company, Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.

Barlo'sky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin. I, '00 (D). Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry. Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.

Basdikis, Charles Apostolos, IV. '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.

Bassett, Louis Loss, VI, '37 (B.T.E.). Salesman, Arthur J. Feinberg, 222 Summer Street, Boston, Mass.

Bates, Wesley Elliot, VI, '36 (B.T.E.). Experimental Department, Saco-Lowell Shops, Biddeford, Me.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beattie, John Silas, IV, '35 (B.T.C.). Textile Research Chemist, Ridgway, Whiting & Bodenschatz, Inc., Nutley, N. J.

Beck, Frederic Christian, II, '24 (D). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). Overseer, Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). Sales and Service, Calgon, Inc., Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler and Designer, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Designer, Atlanta Woolen Mills, Atlanta, Ga.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Field Engineer, Armour Soap Works, North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.

Blake, Parker Gould, VI, '14 (D). Partner, Parker Blake & Clinton Long, Ltd., 54 Wellington Street, West, Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). Assistant Selling Agent, Ludlow Manufacturing and Sales Company, 211 Congress Street, Boston, Mass.

Bogdan, John Francis, VI, '35 (B.T.E.). With Manville Jenckes Corporation, Manville, R. I.

Boordetsky, Sidney Morris, VI, '37 (B.T.E.). With Malden Knitting Mills, Malden, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Technical Salesman, The Huron Milling Company, 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Styler, Joshua L. Bailey & Co., 10-12 Thomas Street, New York City.

Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.

Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.

Bradford, Edward Hosmer, VI, '35 (B.T.E.). Research, Carding Department, Manville-Jenckes Corporation, Manville, R. I.

Bradford, Harold Palmer, II, '25 (D).
Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.
Bradford, William Swanton, VI, '31 (B.T.E.). 138 Main Street, Andover, Mass.
Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.
Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.
Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.
Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.
Brandt, Carl Dewey, VI, '20 (B.T.E.). Research Engineer, Whitin Machine Works, Whitinsville, Mass.
Brannen, Leon Vincent, III, '07 (C).
Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.
Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.
Bridges, Herbert Gardner, II, '34 (D). Unit Manager, Commercial Credit Corporation, Manchester, N. H.
Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears Co., 65 Worth Street, New York City.
Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.
Brosnan, William Francis, IV, '27 (B.T.C.). Overseer of Dyeing, Bradford Dyeing Association, Bradford, R. I.
Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.
Brown, Philip Franklin, II, '23 (D). Assistant Sales Director, E. I. DuPont de Nemours, Rayon Division, Wilmington, Del.
Brown, Rollins Goldthwaite, IV, '12 (D).
Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.
Brown, Will George, Jr., IV, '22 (B.T.C.). Sales Technologist, Wallerstein Company, 180 Madison Avenue, New York City.
Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.
Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.
Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.
Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.
Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.
Burke, James Edward, Jr., IV, '34 (B.T.C.). With Newmarket Manufacturing Company, Lowell, Mass.
Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.
Burns, Robert, IV, '28 (B.T.C.).
Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.
Buzzell, Harry Saville, VI, '29 (B.T.E.). Supervisor of Sample Department, Oxford Paper Company, Rumford, Maine.

Calder, Marian Brownson, VI, '37 (M.S.). (B.S. 1930, College of Industrial Arts, Texas State College for Women.) Teacher, Centenary Junior College, Hackettstown, N. J.
Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.
Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.
Campbell, Alexander, VI, '23 (B.T.E.). Assistant Engineer, Arlington Mills, Lawrence, Mass.
Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.
Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.
Campbell, Orison Sargent, II, '03 (D). Managing Director, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.
Carbone, Alfred John, IV, '31 (B.T.C.). Chemist, Sandoz Chemical Works, 63 Oliver Street, Boston, Mass.
Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Fabrics, Inc., Bridgeport, Conn.
Carr, George Everett, I, '05 (D). Industrial Engineer, C. F. Mueller Company, 180 Baldwin Avenue, Jersey City, N. J.
Carr, Paul Edward, II, '24 (D). Styler, Deering, Milliken & Co., 450 Seventh Avenue, New York City.
Carter, Robert Albion, IV, '02 (D). District Manager, DuPont Dyestuffs, E. I. du Pont de Nemours & Co., Birdsboro, Pa.
Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.
Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.
Casey, Francis Harold, IV, '31 (B.T.C.). With Sandoz Chemical Works, Inc., Boston, Mass.
Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.
Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.
Chandler, Proctor, IV, '11 (D). Manager, Barbour Mills, Montello, Mass.
Chang, Chi, VI, '23 (B.T.E.).
Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.
Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.
Chen, Shih Ching, IV, '22 (B.T.C.).
Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.
Church, Charles Royal, II, '06 (C). Teacher and Athletic Coach, San Diego High School, San Diego, Calif.
Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.
Clark, Earl William, IV, '18 (B.T.C.). 231 Anderson Place, Buffalo, N. Y.
Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.
Clarke, George Dean, II, '21 (C). 338 East Main Street, Avon, Mass.
Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mills, Inc., Lowell, Mass.
Cleary, Charles Joseph, II, '13 (D). Textile Technologist, United States Army Air Corps, Dayton, Ohio.
Clement, David Scott, IV, '24 (B.T.C.). Overseer of Dyeing, Nashua Manufacturing Company, Nashua, N. H.
Cleveland, Richard Sumner, VI, '30 (B.T.E.). Assistant Textile Technologist, National Bureau of Standards, Washington, D. C.
Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.
Clogston, Raymond B., IV, '04 (D). Divisional Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.
Cluett, John Girvin, I, '29 (D). Foreman of Examining at Bleachery, Cluett, Peabody & Co., Inc., Waterford, N. Y.
Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.
Cobb, Joseph Calvin, VI, '36 (B.T.E.). With Thermoid Company, Trenton, N. J.
Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.
Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.
Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.
Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3006, New York City.
Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Assistant Superintendent, Hohokus Bleachery, Hohokus, N. J.
Cole, Edward Earle, IV, '06 (D). 191 Merrimack Street, Haverhill, Mass.
Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.
Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.

Conant, Harold Wright, I, '09 (D). Assistant Treasurer, United Elastic Corporation, Easthampton, Mass.
Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears Company, 65 Worth Street, New York City.
Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.
Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.
Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.
Connorton, John Joseph, Jr., III, '27 (D).
Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.
Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.
Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.
Cowan, Raymond Bernard, IV, '35 (B.T.C.).
Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.
Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.
Crane, Eugene Francis, II, '33 (D). 67 Loring Street, Lowell, Mass.
Crawford, Robert Thomas, VI, '36 (B.T.E.). Development Engineer, Tennessee Eastman Corporation, Kingsport, Tenn.
Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.
Crowe, Joseph Bailey, IV, '25 (B.T.C.). Director of Laundry and Textile Research, Procter & Gamble Co., Ivorydale, Ohio.
Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.
Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, Ralph E. Loper & Co., Greenville, S. C.
Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.
Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.
Currier, John Alva, II, '01 (D). Superintendent of Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.
Curtin, William John, IV, '35 (B.T.C.). Insurance Agent, John Hancock Mutual Life Insurance Company, Lowell, Mass.
Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.
Curtis, William Leavitt, II, '05 (C).
Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.
Cuttle, James H., II, '99 (D). Director, S. Stroock & Co., Inc., Newburgh, N. Y.

Daley, Charles Lincoln, IV, '34 (B.T.C.). With National Aniline & Chemical Co., Buffalo, N. Y.
Dalton, Gregory Smith, IV, '12 (D).
Daly, William James, VI, '37 (B.T.E.). Executive Training Group, Sears-Roebuck Company, Cambridge, Mass.
Danahy, Arthur Joseph, IV, '31 (B.T.C.). Chemist, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.
Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.
Datar, Anant Vithal, VI, '24 (B.T.E.). Manager, The Chalisgaon Shri Laxmi Narayan Mills Co., Ltd., Chalisgaon, E.K., India.
Davidson, Sydney, III, '28 (D). 301 Allston Street, Brighton, Mass.
Davieau, Alfred Edward, VI, '16 (D). Chief of Textile Section, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.
Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd., (F. C. Huyck & Sons), Arnprior, Ont.
Davieau, Leon Arthur, VI, '23 (B.T.E.). With United States Rubber Products, Inc., Market and South Streets, Passaic, N. J.
Davis, Alexander Duncan, VI, '14 (B.T.E.). Instructor, Northeastern University, Springfield, Mass.
Dearborn, Roy S., VI, '13 (D). With Real Estate Department, Andover Savings Bank, Andover, Mass.
deGruchy, James Campbell, Jr., IV, '36 (B.T.C.). Chemist and Dyer, Goodall Worsted Company, Sanford, Me.

Del Plaine, Parker Haywood, IV, '25 (B.T.C.). Southern Manager, Rohm & Hass Company, Inc., 1109 Independent Building, Charlotte, N. C.

Dempsey, Phillip Edward, IV, '33 (B.T.C.). Chemist, American Aniline Products, Inc., Boston, Mass.

Derby, Roland Everett, IV, '22 (B.T.C.). Chemist, M. T. Stevens & Sons Company, North Andover, Mass.

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Dewey, James French, II, '04 (D). President and Treasurer, A. G. Dewey Company, Quechee, Vt.

Dewey, Maurice William, II, '11 (D). Inspector of Real Estate, National Life Insurance Company, Montpelier, Vt.

Dillon, James Henry, III, '05 (D).

Dion, Ernest Lorenzo, IV, '35 (B.T.C.). With Pacific Mills, Worsted Division, Lawrence, Mass.

Dods, James Barber, II, '27 (D). Vice-President, The Dods Knitting Company, Ltd., Orangeville, Ont.

Dolan, William Francis, IV, '28 (B.T.C.).

Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.

Donohoe, Edward Joseph, VI, '34 (B.T.E.). Textile Engineer, United States Testing Company, Inc., Hoboken, N. J.

Donovan, Joseph Richard, IV, '24 (B.T.C.). 81 Strathmore Road, Brookline, Mass.

Doran, Wilbur Kirkland, II, '22 (D).

Dorr, Clinton Lamont, VI, '14 (D). General Manager, Raymond's, Inc., 356 Washington Street, Boston, Mass.

Douglas, Walter Shelton, II, '21 (D). Estimator, Douglas & Co., Lowell, Mass.

Dudley, Albert Richard, VI, '33 (B.T.C.). With Chicopee Manufacturing Corporation, Manchester, N. H.

Duggan, Paul Curran, IV, '31 (B.T.C.). Chemist, Gotham Silk Hosiery Company, 580 First Avenue, New York City.

Duguid, Harry Wyatt, I, '24 (D). Assistant Superintendent, Maverick Mills, East Boston, Mass.

Dunlap, Kirke Harold, Jr., VI, '30 (B.T.E.). Textile Engineer, Kenwood Mills, Ltd., Arnprior, Ont.

Dunlap, Parker Frank, VI, '34 (B.T.E.). Textile Engineer, Chicopee Manufacturing Corporation, Chicopee Falls, Mass.

Dunnican, Edward Tunis, VI, '24 (B.T.E.). Instructor in Textile Work, Passaic Public Schools, Passaic, N. J.

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Dursin, Louis Jules, II, '36 (D). Superintendent, Rochambeau Worsted Company, Olneyville, R. I.

Duval, Joseph Edward, II, '10 (D). Sales Manager, Massachusetts Mohair Plush Company, 3701 North Broad Street, Philadelphia, Pa.

Dwight, John Francis, Jr., II, '08 (D). Hazel Avenue, Scituate, Mass.

Echavarria, Luis, VI, '35 (B.T.E.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia.

Echecopar, Jesus Fortunato, VI, '33 (B.T.E.). Director-Gerent de Eguren, Echecopar y Cia. S.A. and Profesor de Tecnologia Textil en la Escuela de Ingenieros, Lima, Puer.

Echmalian, John Gregory, VI, '16 (B.T.E.). Director, State Trade School, Manchester, Conn.

Ehrenfried, Jacob Benjamin, II, '07 (C). District Manager, Maine State Employment Service, Lewiston, Me.

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Elliott, Gordon Baylies, II, '12 (D). Planning Department, Pacific Mills, Lawrence, Mass.

Ellis, Charles Albert, VI, '21 (B.T.E.). 901 Danforth Street, Syracuse, N. Y.

Ellis, Dorothy Myrta, VI, '25 (B.T.E.). Agricultural Economist, Department of Agriculture, Washington, D. C.

Ellis, James Oliver, VI, '29 (B.T.E.).

Engstrom, Karl Emil, VI, '12 (D). (S.B. 1916, Massachusetts Institute of Technology.) 36 Fairfield Street, Boston, Mass.

Enloe, Winfred Paige, I, '22 (D). Agent, The W. A. Handley Manufacturing Company, Roanoke, Ala.

Evans, Alfred Whitney, III, '03 (D).

Evans, Paul Richard, II, '29 (D). District Manager, Economics Laboratory, Inc., Philadelphia, Pa.
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Everett, Charles Arthur, IV, '19 (B.T.C.). Instructor, Dyeing Department, Lowell Textile Institute, Lowell, Mass.

Fairbanks, Almonte Harrison, II, '09 (D). President and Manager, Fairwood Knitting Mills, Wakefield, Mass.
Fairbanks, Evan Hobbs, VI, '35 (B.T.E.). With J. T. Reed & Co., Charlestown, Mass.
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Farley, Clifford Albert, VI, '28 (B.T.E.). Assistant Felt Designer, F. C. Huyck & Sons, Rensselaer, N. Y.
Farmer, Chester Jefferson, IV, '07 (D). **(Ph.D. Harvard University.)** Professor of Chemistry, Northwestern University Medical School, Chicago, Ill.
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Farr, Leonard Schae'ar, II, '08 (D). With A. D. Ellis Mills, Inc., Monson, Mass.
Farwell, Claude Chapman, VI, '23 (B.T.E.). Groton, Mass.
Fasig, Paul Leon, IV, '28 (B.T.C.). With Kramer Hosiery Company, Nazareth, Pa.
Feinberg, Benjamin, II, '27 (D). With Copley Realty Company, Boston, Mass.
Feindel, George Paul, IV, '24 (B.T.C.). Assistant Superintendent, Rock Hill Printing & Finishing Company, Rock Hill, S. C.
Feldstein, Martin Alexander, VI, '24 (B.T.E.). Radio Engineer, Amplex Instrument Laboratories, New York City.
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Ferguson, Thomas Dickson, VI, '32 (B.T.E.). With Gilbert Knitting Company, Little Falls, N. Y.
Ferguson, William Gladstone, III, '09 (D). Assistant Agent, Ludlow Manufacturing Associates, Ludlow, Mass.
Ferris, Arthur Leon, II, '28 (D). Port Rowan, Ont.
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Fisher, Russell Todd, VI, '14 (D). **'25 (B.T.E.).** President, National Association of Cotton Manufacturers, 80 Federal Street, Boston, Mass.
Fisher, Thomas Nathan, VI, '37 (B.T.E.). With American Manufacturing Company, Brooklyn, N. Y.
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Fleming, Frank Everett, IV, '06 (D). Superintendent, Dyeing and Finishing, Goodall Worsted Company, Sanford, Maine.
Fletcher, Howard Varnum, III, '25 (D).
Fletcher, Roland Hartwell, VI, '10 (D). Engineering Department, Pressed Steel Car Company, Pittsburgh, Pa.
Flood, Thomas Henry, IV, '27 (B.T.C.). Chemist, National Aniline & Chemical Company, Toronto, Ont.
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Forsaith, Charles Henry, VI, '20 (B.T.E.). Superintendent, Nashua Manufacturing Company (Jackson Mills), Nashua, N. H.
Forsaith, Ralph Allen, VI, '16 (B.T.E.). In charge of Textile Section, Anderson-Meyer Company, Ltd., Shanghai, China.
Forsyth, Harold Downes, VI, '23 (B.T.E.). Treasurer, Wm. Forsyth & Sons Company, West Lynn, Mass.
Forsythe, George, VI, '34 (B.T.E.). With the Chicopee Manufacturing Corporation, Chicopee Falls, Mass.
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Foster, Clifford Eastman, II, '01 (D). Overseer, National Silk Spinning Company, New Bedford, Mass.

Fowle, Edwin Daniels, VI, '24 (B.T.E.). With McGraw-Hill Publishing Company, Boston, Mass.

Fox, David James, VI, '34 (B.T.E.). Textile Technician, Celanese Corporation of America, Amcelle, Md.

Franks, Jerome, VI, '27 (B.T.E.). (M.S. 1929, Massachusetts Institute of Technology.) With Marillyn Silk Mills, Phillipsburg, N. Y.

Frederickson, Charles Joseph, Jr., IV, '29 (B.T.C.). Chemist, White & Hodges, Everett, Mass.

French, Wallace Howe, IV, '31 (B.T.C.). Overseer of Dyeing, Atlas Underwear Company, Richmond, Ind.

Frost, Harold Benjamin, II, '12 (D). Resident Manager, Liberty Mutual Insurance Company, Brockton, Mass.

Fuller, Allen Reed, IV, '17 (B.T.C.). Textile Chemist, A. E. Staley Manufacturing Company, Decatur, Ill.

Fuller, George, I, '03 (D). Consulting Textile Specialist, Cox and Fuller, 320 Broadway, New York City.

Gagnon, Roland Joseph Octave, IV, '36 (B.T.C.). 7 Hillcrest Circle, Nashua, N. H.

Gahm, George Leonhard, II, '06 (D). Superintendent, Worsted Yarns, Wood Worsted Mills, Lawrence, Mass.

Gainey, Francis William, IV, '11 (D). Colorist, National Aniline & Chemical Co., Buffalo, N. Y.

Gale, Harry Laburton, III, '10 (D). With J. P. Stevens Company, 44 Leonard Street, New York City.

Gallagher, Arthur Francis, IV, '30 (B.T.C.). Overseer of Dyeing, Hillsborough Mills, Wilton, N. H.

Gallagher, John Waters, II, '27 (D). Groveland Hotel, Danbury, Conn.

Garlick, Mrs. Dorothy M. (Burbeck, Dorothy M.), IV, '20 (B.T.C.). 192 Great Road, Maynard, Mass.

Garner, Allen Frank, II, '30 (D). Assistant Manager, Kezar Falls Woolen Company, **Kezar Falls, Me.**

Gaudet, Walter Urban, II, '29 (D). Service Department, Liberty Mutual Insurance Company, Charlotte, N. C.

Gay, Leon Stearns, Jr., II, '37 (D). With Gay Brothers Company, Cavendish, Vt.

Gay, Olin Dow, II, '08 (D). President, Gay Brothers Company, Cavendish, Vt.

Georgacoulis, George, IV, '36 (B.T.C.). Assistant Chemist, Du Pont de Nemours, Arlington, N. J.

Gerrish, Walter, III, '03 (D).

Gifford, Alden Ives, Jr., VI, '34 (B.T.E.). Research Engineer, Pepperell Mfg. Co., Biddeford, Me.

Gillespie, Francis Clifford, IV, '34 (B.T.C.). Dyeing Department, Pacific Print Works, Lawrence, Mass.

Gillie, Stanley James, I, '22 (D). Manager, United States Testing Company, Inc., 255 North Greene Street, Greensboro, N. C.

Gillon, Sara Agnes, IIIb, '06 (C).

Gilman, Ernest Dana, II, '26 (D). Designer, Pacific Mills, Worsted Division, Lawrence, Mass.

Gleklen, Leo, IV, '32 (B.T.C.). Boss Dyer, Hope Knitting Company, Pawtucket, R. I.

Glickman, Bernhardt Brecher, IV, '27 (B.T.C.). (B.S. 1931, Columbia University.)

Glowacki, Joseph, VI, '32 (B.T.E.). 105 Salem Street, Andover, Mass.

Glowienski, Mitchell, IV, '34 (B.T.C.). With Arlington Mills, Lawrence, Mass.

Godfrey, Harold Thomas, VI, '26 (B.T.E.). Director and Salesman, Davis & Furber Machine Co., North Andover, Mass.

Goldberg, George, VI, '10 (D). Liberty Lace and Braid Company, 88 Bedford St., Boston, Mass.

Goldenberg, Louis G., VI, '27 (B.T.E.). Foreman of Knitting, Raynit Mills, Brooklyn, N. Y.

Goldman, Moses Hyman, IV, '20 (B.T.C.). Manufacturer of Chemical Specialties, Goldman's Moleo Products Company, 210 Broadway, Everett, Mass.

Golec, Edward Lucian, III, '32 (D). With Manhattan Shirt Company, New York City.

Goller, Harold Poehlmann, II, '23 (D). Salesman, Seydel Chemical Company, Greenville, S. C.

Goodhue, Amy Helen, IIIb, '00 (C). See Harrison, Mrs. Arthur.
Gooding, Francis Earle, IV, '19 (B.T.C.). Superintendent, Calco Chemical Company, Bound Brook, N. J.
Goosetrey, Arthur, IV, '21 (B.T.C.). With French Worsted Company, Woonsocket, R. I.
Goosetrey, John Thomas, IV, '21 (B.T.C.). Overseer of Dyeing, New York Mills Corporation, New York Mills, N. Y.
Gottschalck, Lawrence William, VI, '28 (B.T.E.). Sales Office, Scott & Williams, Inc., 366 Broadway, New York City.
Gould, Norman Culver, VI, '19 (B.T.E.). Textile Designer, F. C. Huyck & Sons, Albany, N. Y.
Graham, Robert Theodore, IV, '34 (B.T.C.). Sales Service Section, DuPont Rayon Company of New York at the Aberfoyle Manufacturing Company, Chester, Pa.
Greenbaum, Herbert Baron, III, '29 (D). Salesman, Glenerry Woolen Company, New York City.
Greenbaum, Hyman Herbert, IV, '35 (B.T.C.). Assistant Dyer and Chemist, Merrimack Hat Corporation, Amesbury, Mass.
Greenberg, Archie, II, '21 (D). President, Archie Greenberg, Inc., Worcester, Mass.
Greendonner, George John, Jr., IV, '30 (B.T.C.). With National Aniline & Chemical Co., Inc., Buffalo, N. Y.
Greenwood, John Roger, II, '27 (D). Superintendent, W. W. Windle Company, Millbury, Mass.
Gregory, Robert Crockett, VI, '34 (B.T.E.). Textile Engineer, Firestone Tire & Rubber Co., Akron, Ohio.
Griffin, Vernon Harcourt, IV, '35 (B.T.C.). Overseer of Finishing and Dyeing, Samson Cordage Works, Shirley, Mass.
Gross, Herman Peter, IV, '30 (B.T.C.). 94 Shanley Avenue, Newark, N. J.
Guild, Lawrence Winfield, VI, '27 (B.T.E.). Sales Executive, L. W. Guild Company, Inc., 140 Harrison Avenue, Boston, Mass.
Gwinnell, George Harry, II, '25 (D). Head Designer, Berkshire Woolen Company, Pittsfield, Mass.
Gyzander, Arne Kolthoff, IV, '09 (D). Chemist, National Aniline and Chemical Co., Inc., 40 Rector Street, New York City.

Haddad, Nassib, VI, '23 (B.T.E.). Textile Engineer, General Laboratory, United States Rubber Products, Inc., Passaic, N. J.
Hadley, Richard Francis, IV, '22 (B.T.C.). Salesman, Parks & Woolson Machine Company, Springfield, Vt.
Hadley, Walter Eastman, IV, '08 (D). Chief Chemist, Standard Coosa Thatcher Company, Chattanooga, Tenn.
Hadley, Wilfred Nourse, II, '22 (D). Manager, Parks & Woolson Machine Company, Springfield, Vt.
Hager, Hazen Otis, II, '21 (C). Manager, Suburban Gas Company, Portland, Maine.
Hakanson, Gustave Warren, IV, '37 (B.T.C.). Textile Chemist, Tennessee Eastman Corporation, Kingsport, Tenn.
Hale, Alfred Sandel, IV, '09 (D). Vice-President and Treasurer, Liondale Bleach, Dye & Print Works, Rockaway, N. J.
Hale, Ralph Edgar, IV, '31 (B.T.C.). Textile Chemist, The Bell Company, Worcester, Mass.
Hall, Frederick Kilby, VI, '24 (B.T.E.). (**A.M. 1930, The George Washington University.**) Captain, U. S. Army Quartermaster Depot, Philadelphia, Pa.
Hall, Stanley Arundel, IV, '31 (B.T.C.). With Haverhill Electric Co., Haverhill, Mass.
Halsell, Elam Ryan, I, '04 (C). Assistant Superintendent, Whittenton Manufacturing Company, Taunton, Mass.
Hammond, Chester Twombly, II, '23 (D). Sales Organization, Mohawk Carpet Mills, Inc., Boston, Mass.
Hanscom, Edwin Thomas, II, '27 (D). Hartford, Vt.
Hardie, Newton Gary, I, '23 (D). General Superintendent, Chadwick Hoskins Company, Charlotte, N. C.
Hardman, Joseph Edwin, IV, '32 (B.T.C.). 1102 Chelmsford Street, Chelmsford, Mass.
Hardy, Philip Lewis, VI, '10 (D). Contractor, Andover, Mass.
Harmon, Charles Francis, I, '99 (D).
Harrington, Thomas, IV, '15 (D). President, Hart & Harrington, 925 Weed Street, Chicago, Ill.
Harris, Charles Edward, I, '05 (D). Superintendent, Martin Trailer Company, Westfield, Mass.

Harris, George Simmons, I, '02 (C.) Treasurer, Springs Cotton Mills, Lancaster, N. C.

Harrison, Mrs. Arthur (Goodhue, Amy Helen), IIIb, '00 (C). R. F. D. No. 2, Lowell, Mass.

Hart, Arthur Norman, IV, '19 (B.T.C.).

Hart, Howard Roscoe, I, '23 (D). General Superintendent, Greenwood Cotton Mill, Matthews Cotton Mill, Ninety-Six Cotton Mill, Greenwood, S. C.

Harwood, Ralph, IV, '35 (B.T.C.).

Haskell, Walter Frank, IV, '02 (D). Overseer of Dyeing, Dana Warp Mills, Westbrook, Maine.

Hassett, Paul Joseph, IV, '12 (D). With L. C. Smith & Corona Typewriters, Inc. Cortland, N. Y.

Hathaway, William Tabor, II, '26 (D). Cashier, Secretary of State, Commonwealth of Massachusetts, Boston, Mass.

Hathorn, George Wilmer, IV, '07 (D). Chemist, Lawrence Gas & Electric Company, Lawrence, Mass.

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Hay, Ernest Crawford, II, '11 (D). Superintendent, Monomac Spinning Company, Lawrence, Mass.

Haynes, Amos Kempton, IV, '29 (B.T.C.). Southern Sales Representative, Rohm & Haas Co., Inc., 1666 Emory Road, N. E., Atlanta, Ga.

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Hegy, Gerard John Joseph, VI, '32 (B.T.E.). Dyer, Hegy's, Inc., Cleaners and Dyers, Holyoke, Mass.

Hendrickson, Walter Alexander, II, '11 (D). Superintendent, Bradley Knitting Company, Milwaukee, Wis.

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Hildreth, Harold William, II, '07 (D). Westford, Mass.

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Hoffman, Richard Robert, II, '21 (C).

Holbrook, Ralph Wentworth, IV, '29 (B.T.C.). Chief Chemist and Chemical Purchasing Agent, Crompton Company, West Warwick, R. I.

Holden, Arthur Newton, VI, '36 (B.T.E.). Research, Chicopee Manufacturing Corp., Manchester, N. H.

Holden, Francis Craw'ord, IV, '09 (D).

Holden, John Sanford, II, '20 (D). Manufacturer, Automatic Machine Products Company, Attleboro, Mass.

Holgate, Benjamin, III, '02 (C). Agent, Boott Mills, Lowell, Mass.

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Hollings, James Louis, I, '05 (D). National Resources Board, Washington, D. C.

Hollstein, William Diedrick, VI, '25 (B.T.E.). Student, Philadelphia College of Osteopathy, Philadelphia, Pa.

Holmes, Otis Milton, VI, '13 (B.T.E.). Draftsman, United Shoe Machinery Corporation, Beverly, Mass.

Holt, Laurence Currier, VI, '29 (B.T.E.). Research Technician, Celanese Corporation of America, Amcelle, Md.

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Hook, Russell Weeks, IV, '05 (D). Textile Chemist, Arthur D. Little, Inc., 30 Charles River Road, Cambridge Mass.

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Horne, James Albert, I, '24 (D). Salesman, Wellington, Sears Co., 65 Worth Street, New York City.
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Houghton, Robert Kingsbury, IV, '23 (B.T.C.). Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.
Howard, Lorne Fernley, IV, '32 (B.T.C.). Chemist, B. B. Chemical Company, East Cambridge, Mass.
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Howe, Woodbury Kendall, I, '10 (D). Superintendent, Cotton Department, Merrimack Manufacturing Company, Lowell, Mass.
Howorth, Harmon, VI, '30 (B.T.E.). Celanese Corporation of America, Cumberland, Md.
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Hsu, Hsueh-Chang, VI, '23 (B.T.E.).
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Hubbard, Ralph King, IV, '11 (D). President and Treasurer, Packard Mills, Inc., Webster, Mass.
Huising, Geronimo Huerva, I, '08 (D).
Hunt, Chester Lansing, III, '05 (C).
Hunton, John Horace, II, '11 (D). Supervisor, Textile Industries, Morgan Memorial Co-operative Industries and Stores, South Athol, Mass.
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Hurtado, Leopoldo, VI, '10 (D). General Manager, Hurtado & Co., San Pedro Mill, Uruapan, Michoacan, Mex.
Hurwitz, Jacob, IV, '23 (B.T.C.).
Hutton, Clarence, III, '03 (C). Advertising, Davis & Furber Machine Company, North Andover, Mass.
Huyck, William Francis, II, '34 (D). Personal Loan Department, National Commercial Bank & Trust Co., Albany, N. Y.
Hyman, Wolfred, II, '28 (D). Assistant Manager, Hyman Brothers, Boston, Mass.

Ireland, Wilson Gerard, VI, '36 (B.T.E.). Physical Testing Laboratory, F. C. Huyck & Sons, Albany, N. Y.
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Isaacson, George Franklin, II, '26 (D). With Clarence S. Brown & Co., 40 Worth Street, New York City.
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Jelleme, William Oscar, I, '10 (D). With Pacific Mills, 214 Church Street, New York City.
Jen, Shang Wu, I, '21 (D).
Jessen, Robert Frederick, I, '36 (D). Service Man, Whitin Machine Works, Whitinsville, Mass.
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Johnson, Arthur Kimball, IV, '13 (D). (**S.B. 1917, Massachusetts Institute of Technology.**) Chemist, Neidich Process Company, Burlington, N. J.
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Johnson, Philip Stanley, IV, '24 (B.T.C.).

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Jones, Bliss Morris, IV, '30 (B.T.C.). Sales Engineer, Philadelphia Drying Machinery Company, Philadelphia, Pa.
Jones, Everett Amos, III, '05 (D). Superintendent, Nye & Wait Kilmarnock Corporation, Auburn, N. Y.
Jones, Nathaniel Erskine, I, '21 (D). Foreman, E. L. Watkins Company, Portland, Maine.
Joslin, Harold Wheeler, II, '28 (D). Second Hand, Finishing, Lebanon Woolen Mills, Inc., Lebanon, N. H.
Joy, Thomas, VI, '26 (B.T.E.). Industrial Salesman, Gulf Oil Corporation, Boston, Mass.
Jury, Alfred Elmer, IV, '04 (D). Agent, Winnsboro Mills, Winnsboro, S. C.

Kaatze, Julius, VI, '22 (B.T.E.).
Kaiser, J. Raymond, VI, '36 (B.T.E.). With Pacific Mills, 214 Church Street, New York City.
Kao, Chieh-Ching, VI, '23 (B.T.E.).
Karanfilian, John Hagop, VI, '21 (B.T.E.).
Kay, Harry Pearson, II, '09 (D). Certified Life Underwriter, Penn Mutual Life Insurance Company, Boston, Mass.
Kendall, Charles Henry, II, '23 (D). Superintendent, Bridgewater Woolen Company, Bridgewater, Vt.
Kennedy, Francis Charles, VI, '26 (B.T.E.). Product Development Department, The Fisk Rubber Company, Chicopee Falls, Mass.
Kennedy, James Harrington, Jr., VI, '36 (B.T.E.). Instructor, Worsted Yarn Department, Lowell Textile Institute, Lowell, Mass.
Kenney, Frederick Leo, II, '27 (D). Mill Superintendent, Uxbridge Worsted Company, Uxbridge, Mass.
Kent, Clarence LeBaron, III, '06 (C). Manager, Standard Oil Company, South Portland, Maine.
Keough, Wesley Lincoln, II, '10 (D). Court Clerk, Pasadena, Calif.
Kidder, Glen Mortimer, IV, '34 (B.T.C.). Textile Chemist, The Lux Laboratories (Lever Bros. Co.), Cambridge, Mass.
Killheffer, John Vincent, IV, '28 (B.T.C.). Laboratory Manager, E. I. du Pont de Nemours & Co., Inc., Charlotte, N. C.
Kilmartin, John Joseph, I, '31 (D). Bacteriological Technician, Department of Health, Lowell, Mass.
King, Daniel Joseph, IV, '32 (B.T.C.). 132 Hoyt Avenue, Lowell, Mass.
Kingsbury, Percey Fox, IV, '01 (D). Superintendent of Printing, The Aspinook Company, Jewett City, Conn.
Knowland, Daniel Power, IV, '07 (D). Chemist, Geigy Company, Inc., 89 Barclay Street, New York City.
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Kokoska, Michael George, VI, '33 (B.T.E.). 120 Lakeview Avenue, Lowell, Mass.
Kolsky, Samuel Irving, IV, '30 (B.T.C.). Director, Kolsky Jewelry Co., Lawrence, Mass.
Konieczny, Henry, IV, '30 (B.T.C.). Teacher, Dracut High School, Dracut, Mass.
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Kostopoulos, Emanuel Arthur, VI, '30 (B.T.E.). Textile Inspector, War Department, U. S. Government, Quartermaster's Depot, Philadelphia, Pa.
Krishan, Maharaj, VI, '30 (B.T.E.). Montgomery, India.
Kuo, Limao, VI, '26 (B.T.E.). In charge of Quality Testing Division, Shanghai Bureau of Inspection and Testing of Commercial Commodities, Shanghai, China.

Lamb, Arthur Franklin, II, '10 (D). In business, Cleansing and Dyeing, Rockland, Maine.
Lamont, Robert Laurence, II, '12 (D). Secretary, L. F. Grammes & Sons, Inc., Allentown, Pa.
Lamprey, Leslie Balch, IV, '16 (B.T.D.). Lawrence Post Office, Lawrence, Mass.
Lamson, George Francis, I, '00 (D). 117 Westford Circle, Springfield, Mass.
Lane, John William, I, '06 (C.).
Lane, Oliver Fellows, IV, '15 (B.T.D.). Technical Service, Sales Department, Krebs Pigment and Color Corp., Newark, N. J.
Larratt, John Francis, II, '22 (D). General Overseer, Glenark Mill, Woonsocket, R. I.

Lauder, Robert William, VI, '35 (B.T.E.). Wool Technician, Abbot Worsted Company, Forge Village, Mass.
Laughlin, James Knowlton, III, '09 (D).
Laurin, Eric Thursten Lawrence, IV, '21 (B.T.C.). Superintendent, North Carolina Fabric Corporation, Salisbury, N. C.
Laurin, Sven Albert, IV, '23 (B.T.C.). Minister, Methodist Episcopal Church, Hinsdale, N. H.
Lawson, Russell Monroe, VI, '34 (B.T.E.). Designer, Goodall Worsted Company, Sanford, Me.
Leavitt, George Herbert, II, '26 (D). Time Study Department, F. C. Huyck & Sons, Albany, N. Y.
Leblanc, Gerald Alderic, VI, '34 (B.T.E.).
Lee, Shao-fong, VI, '36 (B.T.E.). Student, Massachusetts Institute of Technology, Cambridge, Mass.
Lee, William Henry, II, '05 (C). Treasurer, John H. Lee & Son, Holyoke, Mass.
Leitch, Harold Watson, IV, '14 (B.T.D.). General Superintendent, Worsted Division, Pacific Mills, Lawrence, Mass.
Lemire, Joseph Emile, VI, '21 (B.T.E.). Mathematics Instructor, Lowell High School, Lowell, Mass.
Leonard, Leo Edward, I, '27 (D).
Leslie, Kenneth Everett, IV, '35 (B.T.C.). Textile Chemist, Ciba Company, Inc., 434 East Allegheny Avenue, Philadelphia, Pa.
Lewis, George Kenneth, VI, '24 (B.T.E.). Divisional Sales Manager, Sonoco Products Company, Mystic, Conn.
Lewis, LeRoy Clark, IV, '08 (D). Representative, Atlantic Dye Works, Paterson, N. J.
Lewis, Walter Scott, IV, '05 (D). Farm Credit Administration, U. S. Government, Washington, D. C.
Lifland, Abraham, IV, '31 (B.T.C.). Assistant Dyer, Artistic Dyeing Company, Brooklyn, N. Y.
Lifland, Bessie, IV, '32 (B.T.C.). See Appel, Mrs. Bessie L.
Lifland, Morris, VI, '33 (B.T.E.). President and General Manager, Suffolk Narrow Fabric Company, Chelsea, Mass.
Lillis, Marvin Hale, IV, '14 (D). 40 Lawrence Street, Lawrence, Mass.
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Lindsly, Walter Coburn, IV, '29 (B.T.C.). Chemist, Sidney Blumenthal & Co., Inc., Shelton, Conn.
Linsey, Edward, II, '25 (D).
Logan, George Leslie, VI, '28 (B.T.E.). Secretary, Tompkins Brothers Company, Syracuse, N. Y.
Lokur, Swamirao Ramrao, IV, '35 (B.T.C.).
Lombard, Carleton Joshua, VI, '23 (B.T.E.). Vice-President, Riggs & Lombard, Textile Machinery, Lowell, Mass.
Loney, Robert William, II, '22 (D). F. C. Huyck & Sons, Kenwood Mills, Albany, N. Y.
Longbottom, Parker Wyman, IV, '21 (B.T.C.). Dyer, Claremont Waste Manufacturing Company, Claremont, N. H.
Loveless, Everton Hanscom, VI, '31 (B.T.E.). Assistant Superintendent, Cotton and Rayon Division, Lorraine Manufacturing Company, Pawtucket, R. I.
Lowe, John Charles, VI, '34 (B.T.E.). Assistant Professor, Department of Worsted Yarns, Lowell Textile Institute, Lowell Mass.
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Lucey, Edmund Ambrose, II, '04 (D). Vice-President and General Manager, Glastonbury Knitting Company, Addison, Conn., and President, Glastonbury Sales Corporation, 93 Worth Street, New York City.
Lussier, Joseph Adrien, II, '27 (D). Staff Superintendent, Hood Rubber Company, Inc., Watertown, Mass.
Lyle, Robert Keith, IV, '37 (B.T.C.). Colorist, National Aniline & Chemical Co., 150 Causeway St., Boston, Mass.

McAllister, Gordon Algeo, IV, '31 (B.T.C.). North Billerica, Mass.
McCann, John Joseph, Jr., VI, '24 (B.T.E.). Engineer, McCann-Stuer, River Works, Andover, Mass.
McCool, Frank Leslie, IV, '10 (D). Resident Manager, Sandoz Chemical Works, Inc., 930 Industrial Trust Building, Providence, R. I.

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McDonald, Gerald Francis, IV, '30 (B.T.C.). Dyer and Plant Chemist, Merrimack Hat Corporation, Amesbury, Mass.

McDonald, John Joseph, IV, '32 (B.T.C.). Teacher of Testing and Dyeing, Textile High School, New York, N. Y.

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McGowan, Frank Robert, VI, '15 (B.T.E.).

McGowan, Henry Earl, VI, '22 (B.T.E.). Principal, The Oakland School, Lowell, Mass.

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Mackay, Stewart, III, '07 (D). Assistant Professor of Textile Design, Lowell Textile Institute, Lowell, Mass.

McKay, Benedict Josephus, IV, '28 (B.T.C.). Stoughton, Mass.

McKenna, Hugh Francis, IV, '05 (D). Chicago Manager, United Indigo and Chemical Company, Ltd., 218 West Kinzie Street, Chicago, Ill.

McKinnon, Norman, VI, '29 (B.T.E.). With Sidney Blumenthal, South River, N. J.

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McKittrick, Raymond Wellington, VI, '28 (B.T.E.). Assistant Manager, Frank G. W. McKittrick, Lowell, Mass.

McLean, Earle Raymond, IV, '30 (B.T.C.). Industrial Fellow, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.

MacPherson, Wallace Angus, III, '04 (D). Designer, Uxbridge Worsted Company, Uxbridge, Mass.

McQuade, Allan John, VI, '36 (B.T.E.). With The Courier-Citizen Printing Company, Lowell, Mass.

McQuaid, Barton Mathewman, IV, '32 (B.T.C.). Government Inspector of Textiles, Philadelphia Quartermaster's Depot, Philadelphia, Pa.

Macher, Henry, II, '23 (D). Secretary, Central Importing Company, Inc., of New Jersey, Passaic, N. J.

Maguire, James Joseph, II, '28 (D). Designer, Uxbridge Worsted Company, Uxbridge, Mass.

Maher, Margaret Mary, IV, '31 (B.T.C.). Laboratory Assistant, Hub Hosiery Mills, Lowell, Mass.

Mahoney, George Stephen, VI, '22 (B.T.E.). Superintendent, Franklin Cotton Mill Company, Cincinnati, Ohio.

Mailey, Howard Twisden, II, '08 (D). Manufacturing Superintendent, Worsted Division, Pacific Mills, Lawrence, Mass.

Manderbach, Harold Mills, VI, '37 (M.S.). (B.A. 1924, University of Michigan.) Captain, U. S. Army Quartermaster Depot, Philadelphia, Pa.

Manning, Frederick David, IV, '10 (D). Budget Director, American Type Founders Company, Elizabeth, N. J.

Marinel, Walter Newton, I, '01 (D). Engineer and Auto Mechanic, Morris Brothers, North Chelmsford, Mass.

Mark, Aris Sawa, VI, '22 (B.T.E.). Sales Department, Franklin Manufacturing Company, Inc., 40 Worth Street, New York City.

Markarian, Haig, IV, '33 (B.T.C.). With Farwell Bleachery, Lawrence, Mass.

Markarian, Moushy, IV, '36 (B.T.C.). Chemist, Arnold Print Works, North Adams, Mass.

Marshall, Chester Stanley, II, '22 (D). Supervisor, Skenandoa Rayon Corporation, Utica, N. Y.

Martin, Harry Warren, IV, '11 (D). With Hood Rubber Company, Inc., Watertown, Mass.

Mason, Archibald Lee, VI, '09 (D). Concord Road, Billerica, Mass.

Mason, Philip Edwin, IV, '26 (B.T.C.). Chemist, Watson Park Company, Ballardvale, Mass.

Mather, Harold Thomas, VI, '13 (D). Inspector, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

Mathieu, Alfred Jules, II, '20 (D). Salesman, Dyeing and Combing, French Worsted Company, Woonsocket, R. I.

Matthews, Elmer Clark, II, '17 (D). Secretary and General Manager, Thermo Mills, Inc., Hudson, N. Y.

Matthews, Raymond Lewis, IV, '34 (B.T.C.). Overseer of Dyeing, Crompton Shenandoah Company, Waynesboro, Va.

Matthews, Robert Jackson, VI, '29 (B.T.E.). Salesman, Pacific Mills, 261 Fifth Avenue, New York City.

Mauersberger, Herbert Richard Carl, III, '18 (D). Technical Editor, Rayon Publishing Corporation, 303 Fifth Avenue, New York City.

Mazer, Samuel, IV, '26 (B.T.C.). In business, Dyer and Converter of Yarns, S. Mazer & Co., Allston, Mass.

Meadows, William Ransom, I, '04 (D). Cotton Registrar, Chicago Board of Trade, Chicago, Ill.

Meehan John Joseph, IV, '32 (B.T.C.). With Warwick Print Works, Bound Brook, N. J.

Meek, Lotta, IIIb, '07 (C). See Parker, Mrs. Herbert L.

Meeker, Samuel, IV, '27 (B.T.C.). Chemist, Aridye Corporation, Fairlawn, N. J.

Megas, Charles, IV, '37 (B.T.C.). Assistant Overseer and Chemist, Millbrook Woolen Mills, Inc., Yantic, Conn.

Meinelt, Herbert Eugene, IV, '32 (B.T.C.). With Lorraine Manufacturing Company, Pawtucket, R. I.

Merchant, Edith Clara, IIIb, '00 (C). Supervisor of Art, Public Schools, Lowell, Mass.

Merrill, Allan Blanchard, IV, '11 (D). Technical Superintendent, B. F. Goodrich Company, Akron, Ohio.

Merrill, Gilbert Roscoe, VI, '19 (B.T.E.). Professor of Textiles; in charge of Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Merrill, John Leslie, VI, '27 (B.T.E.). Instructor in Weaving, Lowell Textile Institute, Lowell, Mass.

Meyers, Chester William, IV, '27 (B.T.C.). Associate Dyer, Massachusetts Knitting Mills, Jamaica Plain, Mass.

Midwood, Arnold Joseph, IV, '05 (D), Salesman, E. I. du Pont de Nemours & Co., 140 Federal Street, Boston, Mass.

Miller, Joshua, VI, '24 (B.T.E.). Material Engineer, Naval Aircraft Factory, Navy Yard, Philadelphia, Pa.

Minge, Jackson Chadwick, I, '01 (C).

Mirsky, Leon Robert, II, '19 (D). 230 West 97th Street, New York City.

Mitchell, Charles Alvah, II, '24 (D). Assistant Superintendent of Woolen Department, Roxbury Carpet Company, Saxonville, Mass.

Moller, Ernest Arthur, II, '22 (D). Eastern Representative, Petroleum Sales Division, The Goodyear Tire & Rubber Co., Inc., Boston, Mass.

Molloy, Francis Henry, II, '16 (D). Salesman, F. C. Huyck & Sons, New York City.

Moody, Leon Eugene, IV, '34 (B.T.C.). Superintendent, U. S. Finishing Company, Sterling, Conn.

Moore, Edward Francis, II, '25 (D). With Ball Band Plant, U. S. Rubber Products, Inc., Mishawaka, Ind.

Moore, Everett Byron, I, '05 (D). With Bridgeport Fabrics, Inc., Bridgeport, Conn.

Moore, Karl Remick, IV, '11 (D). Chief Chemist, Alexander Smith, Yonkers, N. Y.

Moore, William Joseph, IV, '21 (B.T.C.). Colorist, Pacific Mills, Lawrence, Mass.

Moorhouse, William Roy, IV, '01 (D). Resident Manager, National Aniline and Chemical Company, Inc., 150 Causeway Street, Boston, Mass.

Moran, Edward Francis, IV, '32 (B.T.C.). Chemist, Lawrence Manufacturing Company, Lowell, Mass.

Moreno, Emilio Gomez, Jr., VI, '36 (B.T.E.). Draftsman, Whitin Machine Works, Whitinsville, Mass.

Morrill, Howard Andrew, VI, '16 (D).

Morris, Merrill George, IV, '16 (B.T.C.). Chemist, National Aniline & Chemical Co., 357 West Erie Street, Chicago, Ill.

Morrison, Haven Asa, IV, '25 (B.T.C.). Wool Technician, Ciba Company, Inc., New York City.

Morrison, Roland Charles, IV, '34 (B.T.C.). With U. S. Finishing Company, Providence, R. I.

Morse, Judson Pickering, II, '33 (D). Wool Salesman, Lindenfelser & Co., 263 Summer Street, Boston, Mass.

Mullaney, John Francis, VI, '20 (B.T.E.). Higgins & Mullaney, 323 Chalifoux Building, Lowell, Mass.

Mullen, Arthur Thomas, II, '09 (D). Industrial Manager, Commonwealth of Massachusetts, West Concord, Mass.

Munroe, Sydney Philip, I, '12 (D). With Wellington Sears Company, New York City.

Murphy, John Joseph, IV, '33 (B.T.C.). Assistant Chemist, Bates Manufacturing Company, Lewiston, Me.

Murray, James, IV, '13 (D). Chief Chemist, Martin Cantine Company, Saugerties, N. Y.

Murray, James Andrew II, '10 (D). Analyst, Massachusetts Unemployment Compensation Commission, Boston, Mass.

Myers, Walter Flemings, VI, '29 (B.T.E.). Chelmsford, Mass.

Najar, G. George, IV, '03 (D). Overseer of Dyeing, Monument Mills, Housatonic, Mass.

Nary, James Anthony, II, '22 (D). Manager, United States Testing Company, Inc., Chicago, Ill.

Natsios, Basil Andrew, IV, '37 (B.T.C.). 98 Lewis Street, Lowell, Mass.

Nelson, Roy Clayton, II, '21 (C). Resident Manager, Assabet Mills, Maynard, Mass.

Nelson, Russell Sprague, VI, '22 (B.T.E.). With Draper Corporation, Hopedale, Mass.

Nerney, Francis Xavier, IV, '37 (B.T.C.). Colorist, National Aniline & Chemical Co., Buffalo, N. Y.

Neugroschl, Sigmond Israel, I, '21 (D).

Newall, J. Douglas, IV, '09 (D). Agent in charge of Operations, Boston Duck Company and Bondsville Bleachery & Dye Works, Bondsville, Mass.

Newcomb, Guy Houghton, IV, '06 (C). Manager, Philadelphia Dye Sales, E. I. du Pont de Nemours & Co., 1616 Walnut Street, Philadelphia, Pa.

Neyman, Julius Ellis, IV, '15 (B.T.D.). Furniture Dealer, Neyman Furniture Company, 193-199 Middlesex Street, Lowell, Mass.

Nichols, Raymond Elmore, VI, '10 (D). Draftsman, H. E. Fletcher Company, West Chelmsford, Mass.

Niven, Robert Scott, VI, '12 (D). Draftsman, General Electric Company, Lynn, Mass.

Nostrand, Mrs. William L. (Conklin, Jennie Grace), IIIb, '05 (C).

O'Brien, Philip Francis, II, '15 (D). (B.S. New York University, M.A. Fordham University.) Chairman, Textile Department, Textile High School, New York City.

O'Connell, Clarence Edward, IV, '11 (D). Dyer, National Aniline and Chemical Company, Buffalo, N. Y.

O'Connor, Lawrence Dennis, VI, '17 (D). With Beggs & Cobb Winchester, Mass.

O'Donnell, John Delaney, I, '04 (C).

O'Hara, William Francis, IV, '04 (C).

Olson, Carl Oscar, II, '24 (D). Real Estate Salesman, Richard F. Jones, Jr., Hartford, Conn.

Orlauski, Anthony, IV, '32 (B.T.C.). 696 Washington Street, Haverhill, Mass.

Orr, Andrew Stewart, IV, '22 (B.T.C.). Manager, Storey & Co., Brockton, Mass.

Osborne, George Gordon, VI, '28 (B.T.E.). (M. Sc. 1932, North Carolina State College.) With Wellington, Sears Company, Boston, Mass.

Othote, Louis Joseph, I, '23 (D). Salesman J. W. Valentine Co., Inc., 40 Worth Street, New York City.

Palais, Samuel, IV, '18 (B.T.C.). With Worcester Knitting Company, Worcester, Mass.

Parechanian, James Humphrey, IV, '35 (B.T.C.). Development, United States Rubber Company, at the Naugatuck Chemical Company, Naugatuck, Conn.

Parigian, Harold Hrant, IV, '28 (B.T.C.). Chemist, Archer Rubber Company, Milford Mass.

Parker, Everett Nichols, I, '05 (D). President, Parker Spool and Bobbin Company, 27 53 Middle Street, Lewiston, Maine.

Parker, Mrs. Herbert L. (Meek, Lotta L.), IIIb, '07 (C). 4 Brookside Circle, Auburn, Maine.

Parker, Hubert Frederic, VI, '20 (B.T.E.). Engineer, New York & Pennsylvania Co. and Castanea Paper Company, Lock Haven, Pa.

Parker, John George, Jr., IV, '31 (B.T.C.). With George C. Moore Company, Westerly, R. I.

Parkin, Robert Wilson, VI, '27 (B.T.E.). Superintendent, Limerick Yarn Mills, Limerick, Me.

Parkis, William Lawton, I, '09 (D).

Parsons, Charles Sumner, VI, '27 (B.T.E.). With Hathaway Manufacturing Company, New Bedford, Mass.

Peabody, Roger Merrill, II, '16 (D). Superintendent, Watson-Park Company, 261 Franklin Street, Boston, Mass.

Pearlstein, Maxwell, III, '28 (D). Proprietor, Abbotsford Pharmacy, Roxbury, Mass.
Pearson, Alfred Henry, IV, '11 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
Peary, John Ervin, III, '31 (D). Assistant Designer, Wilton Woolen Company, Wilton, Me.
Pease, Chester Chapin, I, '09 (D). Agent, Columbian Mills (Otis Company), Greenville, N. H.
Peck, Carroll Wilmot, IV, '13 (D). Vice-President, George Mann & Co., Inc., Providence, R. I.
Penney, Cabot William, III, '33 (D). Assistant Designer, Wyandotte Worsted Company, Pittsfield, Mass.
Pensel, George Robert, IV, '13 (B.T.D.). Vice-President, Ritter Chemical Company, Inc., Amsterdam, N. Y.
Perkins, John Edward, III, '00 (D). 24 Abbott Street, Pittsfield, Mass.
Perkins, J. Dean, III, '08 (D). Superintendent, Arms Textile Manufacturing Company, Manchester, N. H.
Perlman, Samuel, IV, '17 (B.T.C.). 61 Main Avenue, Passaic, N. J.
Perlmuter, Barney Harold, IV, '23 (B.T.C.). Manufacturer, Mallon Mattress Company, Boston, Mass.
Pero, Richard Omer, II, '31 (D). Intervale Mills, Inc., Quinebaug, Conn.
Peterson, Eric Arthur, IV, '31 (B.T.C.). Chemist, Wyandotte Worsted Company, Waterville, Me.
Petty, George Edward, I, '03 (C). Real Estate, 211 Ashe Street, Greensboro, N. C.
Phaneuf, Maurice Philippe, III, '20 (D). Accountant, Librarie St. Michel, Inc., Boston, Mass.
Phelan, Bernard Michael, IV, '29 (B.T.C.). Assistant Dyer, National Aniline and Chemical Co., 351 Abbott Road, Buffalo, N. Y.
Phelan, Leonard John, IV, '35 (B.T.C.). Textile Colorist, National Aniline & Chemical Co., Buffalo, N. Y.
Pierce, George Whitwell, IV, '25 (B.T.C.). Superintendent of Dyeing and Finishing, Kramer Hosiery Company, Nazareth, Pa., and Queen City Textile Corporation, Allentown, Pa.
Piligian, Hiag Nishan, IV, '32 (B.T.C.). Assistant Dyer, Bay State Thread Works, Springfield, Mass.
Pillsbury, Ray Charles, I, '13 (D). Superintendent, Cheney Brothers, Manchester, Conn.
Pizzuto, Joseph James, Jr., IV, '33 (B.T.C.). 65 Circular Avenue, Pittsfield, Mass.
Plaisted, Webster E., II, '18 (D). Superintendent of Woolens, Pacific Mills, (Worsted Division), Lawrence, Mass.
Plovnick, Max David, IV, '35 (B.T.C.). Textile Chemist, Southern Asbestos Company, Charlotte, N. C.
Poremba, Leo Louis, IV, '35 (B.T.C.). 4 Oak Street, Lowell, Mass.
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Pottinger, James Gilbert, II, '12 (D). Director, Reliance Manufacturing Company, 212 West Monroe Street, Chicago, Ill.
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Pradel, Alois Joseph, III, '00 (D). Designer, Killingly Worsted Company, Danielson, Conn.
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Preston, Harold Lawrence, VI, '30 (B.T.E.). Sales Engineer, Chester C. Stewart Company, 8 Beacon St., Boston, Mass.
Putnam, George Ives, IV, '16 (B.T.D.).
Putnam, Leverett Nelson, IV, '10 (D). Overseer of Dyeing, Pacific Mills (Worsted Division), Lawrence, Mass.
Putnam, Philip Clayton, IV, '13 (D). Overseer of Dyeing, Apponaug Company, Apponaug, R. I.

Quigley, Gerald Francis, IV, '31 (B.T.C.). With Franklin Rayon Corporation, Providence, R. I.
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Radford, Garland, II, '20 (D). Vice-President, Oriental Textile Mills, Houston, Texas.
Ramsdell, Theodore Ellis, I, '02 (D). President, Monument Mills, Housatonic, Mass.
Rawlinson, Richard William, VI, '31 (B.T.E.). Designer, Nashua Manufacturing Company, Nashua, N. H.
Ray, Lloyd Sanford, IV, '30 (B.T.C.). Chemist and Electro Plater, Excelsior Hardware Company, Stamford, Conn.
Raymond, Charles Abel, IV, '07 (D). Silviculturist, Essex, Mass.
Recher, Theodore, VI, '33 (B.T.E.). Sales Manager, R. Recher, Providence, R. I.
Redding, Leslie Capron, II, '26 (D). Assistant Designer, Dunn Worsted Mills, Woonsocket, R. I.
Redmond, James Reynolds, IV, '36 (B.T.C.). With Ciba Co., Inc., New York City.
Reed, Harold Ernest, VI, '37 (B.T.E.). Technical Writer and Editor, International Correspondence Schools, Scranton, Pa.
Reed, Norman Bagnell, I, '10 (D). Manager, Lowell Hosiery Mills, Inc., Lowell, Mass.
Regan, Paul William, IV, '37 (B.T.C.). 103 Sherman Street, Lowell, Mass.
Reinhold, Kurt Herman, VI, '28 (B.T.E.). Statistician, Russell Manufacturing Company, Middletown, Conn.
Reynolds, Fred Bartlett, II, '08 (D). Purchasing Agent, M. T. Stevens & Sons Company, North Andover, Mass.
Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.
Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.
Rice, Josiah Alfred, Jr., III, '20 (D). Merchandise Manager, Marshall Field & Co., 200 Madison Avenue, New York City.
Rice, Kenneth Earl, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Shelton, Conn.
Rich, Edward, IV, '15 (B.T.D.). Manager, Jackson Caldwell Company, East Boston, Mass.
Rich, Everett Blaine, III, '11 (D). "Onacove," Sewall Road, Wolfeboro, N. H.
Rich, Milton Scott, II, '22 (D). Assistant Purchasing Agent, Harvard University, Cambridge, Mass.
Richardson, George Oliver, IV, '16 (B.T.D.). Manager, Special Products Division, National Aniline and Chemical Company, Inc., 40 Rector Street, New York City.
Richardson, Richardson Perry, I, '13 (D). Salesman, H. F. Livermore Company, Boston, Mass.
Riggs, Homer Chase, VI, '17 (B.T.E.). President, Riggs & Lombard, Inc., Lowell, Mass.
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Instructor in Cotton Yarns.
Charles Frederick Edlund, B.S. . . . 272 Merrimack Street.
Instructor in Sales Engineering.
Milton Hindle, B.T.E. . . 25 Thurston Road, Melrose Highlands.
Instructor in Mechanical Drawing.
Horton Brown, B.S. . . . . 178 Atlantic Avenue, Marblehead.
Instructor in Mathematics.
Waldo Ward Yarnall, B.S. . . . . 127 Wentworth Avenue.
Instructor in Physical Education
Elmer Percy Trevors . . . . . . 18 Rhodora Street.
Assistant Instructor in Chemistry.
Paul David Petterson . . . . . . East Chelmsford.
Assistant Instructor in Machine Shop Practice.
Hugh Francis Carroll . . . . 600 High Street, Medford.
Student Instructor in Chemistry
Robert Miller Kennedy . . . . Dunstable.
Student Instructor in Mechanical Drawing.
Kilburn Gray Pease . . . . . . 156 Methuen Street.
Student Instructor in Cotton Yarns.
Herman Timothy Buckley . . . . . East Chelmsford.
Student Instructor in Chemistry.
Walter Ballard Holt . . . . 37 Albert Street.
Bursar
Florence Moore Lancey . . . . . . 46 Victoria Street.
Librarian
Helen Gray Flack, S.B. . . . . . . 445 Stevens Street.
Secretary
Mona Blanche Palmer . . . . 685 Westford Street.
Clerk
Miriam Kaplan Hoffman, S.B. . . . . . . 42 Gertrude Avenue.
Clerk
Howard Dexter Smith, Ph.D. . . . . Dalton Road, Chelmsford.
Evening Instructor in General Chemistry.
Edward W. Dooley . . . . . . 799 Chelmsford Street.
Evening Instructor in Advertising Design.
Vittoria Rosatto . . . . 63 Bradstreet Avenue.
Evening Instructor in Art.
J. Raymond Bradley . . . . 45 Kirke Street.
Evening Instructor in Advertising Design.

JAMES C. BUZZELL Evening Instructor in Electricity	100 Park Avenue, East.
GLEN BOWDEN CASWELL Evening Instructor in Machine Shop.	32 Hampshire Street.
BERTHA C. HOELLRICH Evening Instructor in Art.	99 Park Street, Newton.
DONALD L. HEMMENWAY Evening Instructor in Electricity.	55 Norcross Street.
INEZ L. KELLER Evening Instructor in Art.	22 Chestnut Street, Winchester.
IVAR O. MOBERG Evening Instructor in Weaving.	64 Thirteenth Street.
MARGARET L. SMITH Evening Instructor in Art.	62 Florence Avenue.
JOHN L. DOLAN Evening Instructor in Mathematics.	173 Pleasant Street.
HAROLD R. ANDERSON Evening Instructor in Worsted Yarns.	R.F.D., Westford.
GEORGE P. SILVA Evening Instructor in Diesel Engines.	48 Humphrey Street.
FRANCIS L. DACEY Evening Instructor in Geometry.	4 Horne Street.
CHESTER BROWN Evening Instructor in Weaving.	726 School Street.
WILLIAM J. CHENARD Evening Instructor in Weaving.	656 Gorham Street.

LOWELL EVENING TEXTILE SCHOOL

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1938.	
September 22, Thursday	Registration.
September 29, Thursday	Registration.
October 3, Monday	Opening of evening school.
November 11, Friday	Armistice Day—Holiday.
November 24, Thursday November 25, Friday	Thanksgiving recess. No classes.
December 20, Tuesday	End of first term.
1939.	
January 5, Thursday	Opening of second term.
March 10, Friday	Closing of evening school.
April 6, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card,

which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in

which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjejcts which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

COTTON.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

OPENING AND PICKING.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

CARDING.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

COMBING.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary

to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

DRAWING.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

ROVING.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjejcts of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

RING SPINNING.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studies in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

SPOOLING AND WINDING.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

TWISTING.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

114. Cotton Organization—1 Year.

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 212) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emul-

sions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

217. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

TECHNOLOGY OF WOOL FIBRES—*one evening each week.*

RAW MATERIALS.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

WOOL SORTING.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, $\frac{1}{2}$-blood, $\frac{3}{8}$-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc., is available for outside reading or study.

WOOL SCOURING.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

CARBONIZING.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

WORSTED CARDING AND COMBING—*one evening each week.*

CARDING.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

COMBING.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

MECHANISM AND CALCULATIONS—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

218. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

DRAWING AND SPINNING.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the

functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

219. Air Conditioning—2 Years.

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air breakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equipment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

One evening each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruc-

tion. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313.—Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.

2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

LETTERING.—During the *first year* the student is taught to master the dawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

SHOW CARD DESIGN.—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms. Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate

from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

THEORETICAL CHEMISTRY.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulae valence, periodic law, etc.

NON-METALLIC ELEMENTS.—Study of their occurrence, properties, preparation, chemical compounds, etc.

METALLIC ELEMENTS.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is a follows:—

TECHNOLOGY OF VEGETABLE FIBERS.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ANIMAL FIBERS.—Wool, mohair, silk. Chemial and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ARTIFICIAL FIBERS.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

OPERATIONS PRELIMINARY TO DYEING.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing, silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the

emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

WATER AND ITS APPLICATION IN THE TEXTILE INDUSTRY.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

MORDANTS AND OTHER CHEMICAL COMPOUNDS USED IN TEXTILE COLORING, AND CLASSIFIED AS DYESTUFFS.—Theory of mordants, their chemical properties and application, aluminium mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

NATURAL ORGANIC COLORING MATTERS.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

MINERAL COLORING MATTERS.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

ARTIFICIAL COLORING MATTERS.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT.

510. English Composition—2 Years.

REMEDIAL ENGLISH AND RHETORIC—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

PROBLEMS IN THE INTERPRETATION AND THE APPRECIATION OF LITERATURE—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling,

inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power. horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory undertanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation. testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626 Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basis principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

Accounting Classes

(Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered.

The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1938

Certificates awarded as follows, April 6, 1938:

Cotton Yarns—2 Years.

Phelicien Alfred Archambault, Lowell
Otis Milton Humphrey, Lowell
Samuel Royce McMaster, Lowell

Knitting—1 Year.

John Burton Austin, Reading
Max Cooperstein, Malden
William Joseph Dawson, Lowell

Woolen Yarns—1 Year

William Edward Andrews, N. Andover
Hollis Goodenow Barlow, Maynard
Francis William Bradley, Lawrence
Jack Gilbert, Methuen
Edwin Charles Hughes, Lawrence
Joseph Peter Kort, Lawrence
John Leopold Marselis, Lawrence
Myles Edwin Nuttall, N. Billerica
John Harvey Painter, Methuen
John Stanley Pudlow, Lowell
Millage Stennett Rawnsley, Lowell
Charles Henry Redman, Lowell
Emil Ristaino, Lawrence
Lawrence Ervin Thompson, Haverhill
Joseph Martin Wasiuk, Lowell

Worsted Yarns—2 Years.

George Frederick Cohen, Lawrence
John Orin Fleming, Lawrence
Norman Matthew Fleming, Jr, Lawrence
Arthur Joseph Frank, Lowell
Albert Edwin Greenwood, Lawrence
John Michael Gustartis, Methuen
Wesley David Harper, N. Chelmsford
Peter Herberchuk, Salem, N. H.
Thomas Anthony Knox, Lawrence
Seth Robinson Lambert, Methuen
Paul Albert Lanni, N. Andover
Donald Joseph LeRiche, Lowell
Arnold Chester McQuaide, Lowell
Albert Picking, Westford
Norman Alderson Rayner, Methuen
Lawrence Talantzy, Graniteville
Arthur Norris Thompson, Chelmsford
Clifford Herman Varnum, E. Chelmsford
Raymond Francis Vennard, N. Chelmsf'd
Stanley John Wajda, Lowell
John Norman Ward, N. Chelmsford
Bryce Henry Wilson, Methuen

Wool and Top Making—1 Year

William Rimmington Addy, Dorchester
James Leo Batts, Jr., Methuen
William Beaudette, N. Chelmsford
George Cosman, Cambridge
Robert Holland Cossaboom, N. Chelmsf'd
Francis David Cryan, Lowell
Francis Stanley Dzioba, Lawrence
Joseph James Fratoni, Salem
George Warren Joseph Furey, Lowell
William Joseph Golubisky, N. Chelmsf'd
Donald Gordon, Lowell
Walter Grandalski, Lawrence
Charles Parker Honeyman, N. Chelmsf'd
F. Gardner Hopkins, Jamaica Plain
John Frederick Kinch, N. Chelmsford
Thomas Joseph Lattinville, Jr. Lawrence
Edward Paul McCluskey, Lowell
Edward Francis McLenna, Graniteville
Nathaniel Williams Matthews, Jr. Lowell
Benjamin Morris Mikulis, Jr. N. Chelmsford
James Joseph Missett, Methuen
Clarence Warren Mooar, Andover
Everett Varney Olsen, N. Chelmsford
Roland Douglas Phinney, Lowell
James Taylor Poor, N. Andover
Norman Eric Roberts, Lawrence
Albert Austin Sanford, Lowell
Eldon Stowell, Lowell
Walter Tuniewicz, Lowell

Air Conditioning—2 Years.

Lawrence Clarence Bellegarde, Lowell
Joseph Frederic Burtt, Lowell
Albert Allen Denio, Lowell
Henry Herbert Dowd, Lowell
Lucien Johnston Harmon, Lowell
Richard Mangan Harrington, Lowell
Walter Joseph Jurczak, Lawrence
Donald Joseph LeRiche, Lowell
Harold Norman Logan, Lowell
Charles Joseph Murray, Lowell
Whitman Pearson, Lowell

Cotton Design—3 Years.

Clifford Robert Holgate, Lowell
Patrick Joseph Keegan, Lowell
Walter Capen Wright, Littleton Common

Woolen and Worsted Design—3 Years.

Philip Schubert Benoit, Methuen
Albert Binns, Methuen
Arthur Binns, Methuen
Herve Joseph Blanchette, Lawrence
John Clarke, Methuen
Arthur Robert Clinton, Lawrence
Thomas Vincent Curley, W. Medway
Frederick Darlington, Methuen
Henry Francis Drenth, Methuen
Francis Anthony Dubrawski, Medway
Daniel Earl Huntley, Medway
John Joseph Janowski, Lawrence
Rene Lionel Lacharite, Lawrence
Matthew Adam Novak, Lawrence
Charles Joseph Plummer, Lawrence
Samuel Joseph Smelter, Lawrence
Horace Nathaniel Stevens, Jr.
N. Andover
Alden Robert Walls, Andover

Advertising Design—2 Years.

Norman Gerald Allaby, Lowell
Paul Emile Bolduc, Lowell
Doris Rita Breton, Lowell
Louis Frederick Gagniere, Lowell
George Jardine, Lowell
Maurice Origene Mercier, Lowell
Juliette Marie Poirier, Lowell
Anna Patricia Wrenn, Lowell

Decorative Art—3 Years.

Ruth Helene Blum, Lowell
Marie-Jeanne Roseanna Huot, Lowell
Ann Dorathea Kasinskas, Lowell
Rainhold Hugo Lake, Lowell
Irwin Herbert Laurencelle, Lowell
Mary Petrakos, Lowell
Ingrid Israella Robinson, Lowell

Cotton Weaving—1 Year.

Charles Bazdanes, Lowell
Ernest August Johnson, Nashua, N. H.
Paul Kanelas, Lowell
William Kmiec, N. Andover
Matt Korol, Manchester, N. H.
Henry Raymond Krystyniak, Lowell
Gabrielle Eugenie Lagasse, Lowell
Edward John Maslanka, Lowell
Charles James Metropolis, Lowell
George Arthur Pappas, Lowell
Emil Charles Piekos, Lowell
Mitchell Charles Stec, Lowell
Joseph Anthony Stewart, Lowell

Woolen and Worsted Weaving—1 Year.

Edward Joseph Bacher, Andover
Joseph Frank Baron, Lowell
Leo William Conlin, Lowell
Francis Joseph Dion, Lowell
Herbert Francis Donaghey, Andover
Arthur James Flanagan, N. Andover
William Peter Gaudaitis, Lawrence
Philippe Maurice Gauthier, Lowell
William Scott Glendenning, N. Andover
John Henry Hargreaves, Methuen
John Holden, Lawrence
Wilfred Craven Holroyd, Methuen
Edward Baxter Kirwin, Andover
Arthur Omer Leclair, Lowell
Rudolph Augusta Mackie, Lowell
Raymond Fabien Maille, Lowell
Frank Leo Makrecky, Maynard
Thomas James Megdanis, Lowell
Andrew John Mitzcavitch, Maynard
John Joseph Molda, Lowell
Albert Joseph Morin, Lowell
William Arthur Morin, Lawrence
Joseph Richard Mozykowski, Lowell
David Murray, Lawrence
Theodore Andrew Patenaude, Lowell
Walter Jerome Patenaude, Lowell
Wilbur Woodrow Pearson, Methuen
Walter Knot Peterson, Dracut
Adam Anthony Potsavich, Lawrence
Noe George Provencher, Lowell
Thomas Aloysius Reynolds, Lowell
Harold Richard, Lawrence
William Maxwell Thomson, Lawrence
Otho Wilton Tompkins, Lawrence
Roland Joseph Toupin, Lowell
Joseph Joseph Walsh, Jr., Maynard
William Charles Wasiuk, Maynard
Joseph Francis Wessells, Lowell
Donald Everett Williams, Dracut

Loom Fixing—1 Year.

Christos Anganes, Lowell
George Gordon Armstrong, Jr. Littleton
Kenneth William Bardsley, Lawrence
Joseph Calixte Boisvert, Lowell
Arthur Denis Boucher, Lowell
Andrew Joseph Brouillette, Lowell
Albert Armand Catineau, Lawrence
Hector Joseph Dalphond, Lowell
Harry Page Day, Salem
Walter Lacheta, Manchester, N. H.
Raymond Joseph Laliberte, Lawrence
Donat George Lamourex, Lowell
Wilfred Avila Lepine, Lowell
Henry John Panek, Lowell
James Pappas, Lowell
Raymond Edward Skelley, Salem
Charles Tzikopoulos, Lowell
Clifford Walton, Lawrence

Woolen and Worsted Finishing—1 Year.

Thomas Gordon Armour, Methuen
Charles Edward Bauchman, Lawrence
Chester Robert Bell, Lowell
Stanley Chwalek, Lawrence
Gordon Kenneth Crawford, Methuen
George William Daley, Haverhill
Hugh Raymond Dunn, Lowell
George Clifford Emmons, Andover
Charles John Frey, Lawrence
John Fraser Giffin, Wilton, N. H.
Bert Gilbert, Methuen
Charles Norman Gregoire, Wilton, N.H.
Frederick Richard Holt, N. Andover
Raymond Maxime Lafortune, Lowell
David Williamson Lawrie, Lawrence
Arthur Thomas Little, Methuen
Leno Mendaca, Lawrence
Thomas Bernard Murray, Lawrence
George Albert Nahill, Lawrence
John Nauiokas, Lawrence
B. Vincent Oldfield, Lawrence
Joseph John Orlando, Methuen
Leslie Packard, Methuen
Evariste Joseph Pepin, Lawrence
John Francis Sedlesky, Lowell
John Taylor, Jr. Methuen
John Henry Terris, N. Billerica
William Albert Theriault, Lawrence
Frank Thompson, N. Andover
Robert Griffin Thompson, Haverhill
Herbert Clinton Vose, Wilton, N. H.
Irving Melvin Weighill, Lawrence

Analytical Chemistry—3 Years.

Walter Samuel Bean, Jr., Lowell
Alfred Calabrese, E. Boston
John Doulames, Lowell
Weldon Maxwell Huckins, Woburn
Paul Bernard Klier, Lawrence
John Erwin Martin, Lowell
Herbert Neild, Lowell
Herve Armand Paquin, Lowell
Edward Wallace Rutyna, Lowell

Textile Chemistry and Dyeing—3 Years.

William Gray Bailey, Newton Highlands
Guido Joseph Cianci, Lawrence
Najie Elias Daher, Lawrence
William Arthur Drummond, N. Andover
George Henry Ennis, N. Billerica
Harry Ralph Johnson, Lawrence
Joseph Vincent King, Bradford
Ernest Albert Lehninger, Methuen
John Joseph Morrison, Lawrence
Donald Raymond Neil, Lowell
George Rodney Schmottlach, Lawrence
Anthony John Villani, Lawrence

Elementary Chemistry—2 Years.

Chester Burton Brown, Methuen
Richard Stearns Bunting, Methuen
Harry Chadwick, Andover
Edward Cherowbrier, Jr., Andover
Ronald Clamp, Methuen
Albert Gordon Coates, Ballardvale
Charles Frederick Connors, Woburn
Thomas Patrick Fitzgerald, Lawrence
Walter Frank Gacek, Lowell
Donald Edward Gagnon, E. Pepperell
Harvey George Gendreau, Lowell
Walter Ginsburg, Roxbury
Maryclare Rita Hayes, Lowell
James William Holden, Lowell
Gilbert Oscar Just, Methuen
Magan Samuel M. Krasnecki, N. Chelmsford
Charles Eugene Lisien, Lowell
Walter Lisien, Lowell
Grace Mary McMenimon, Lowell
Harold Clifton Malloy, Westford
Kenneth Raymond Morley, Methuen
Emanuel Naparstek, Lowell
Alberton Vinal Olsen, N. Chelmsford
Dennison Kimball Peel, Haverhill
Edward Francis Poremba, Lowell
Joseph Thomas Provissia, Lawrence
Daniel Francis Quealy, Lowell
Paul Gould Robbins, Jr., Lawrence
Wilbur Hartley Roberts, Lowell
Charles William Saalfrank, N. Andover
Russell Charles Sheehan, Lowell
John Hollywood Shinner, Methuen
Charles Joseph Stahle, Lawrence
Dore Earle Tyler, Lowell
Herbert Ernest Wieland, Lawrence
Joseph Peter Willan, Lawrence
Robert Winslow, Salem, N. H.
James Lincoln Wolfindale, Lawrence

Mechanical Drawing—3 Years.

Real Edward Bourque, Lawrence
Fernando Etienne Charest, Nashua, N.H.
Amedee Ronald Cote, Lowell
Gilles Bernard Cote, Manchester, N. H.
Paul Albert Daigle, Lawrence
Raymond Lionel Dupont, Nashua, N. H.
Paul Lucien Gauthier, Lowell
Charles Merrill Hamblett, Lowell
Robert George Hewson, Methuen

Alternating Current Electricity—2 Years.

Lawrence Francis Gauthier, Nashua, N. H
Arthur Evans Gay, Nashua, N. H.
Edward Freeland Jones, Lowell
Frank Joseph Rochette, Lowell
Charles Bernard Wilson, Methuen
Lloyd Arnold Wilson, Methuen

Direct Current Electricity—2 Years.

Clarence Everett Foster, Dracut
Thomas Joseph Harding, Lowell
Francis John Hopkins, Lowell
Alexander Joseph Kotarba, Lowell
Denis Arthur Lebel, Lowell
John Thompson McCormick, Chelmsford
Edmund Stevens McDonagh, Lowell
Raymond Thomas McDonagh, Lowell
William Asa Todd, Lawrence
Vosken Tomasian, Nashua, N. H.

Steam—1 Year.

George Gordon Armstrong, Littleton
John Edward Birchall, Lowell
Normand Robert Demers, Nashua, N.H.
Murdock Welcome Weathers, Lowell
Donald Harriman Wentworth, Lowell

Machine Shop Practice—2 Years.

Gerard Armand April, Lowell
Alfred Joseph Archambault, Lowell
Lucien Armand Arsenault, Lowell
Lloyd James Aspinall, Lowell
Alphonse Louis Bilewick, Lowell
Leon Joseph Bolduc, Lowell
Arthur Huntley Cady, Nashua, N. H.
Theodore Edward Chmura, Lawrence
Albert Eugene Dery, Lowell
George Edward Dery, Lowell
Clifford Joseph Duhamel, Methuen
Cyrill Feugill, Jr., Methuen
Arthur Fluet, Jr., Lawrence
Gerard Alphonse Fluet, Lawrence
William Francis Garrigan, Lowell
Michael John Karos, Nashua, N. H.
Alfons Bartholomew Kleponis, Lawrence
William Paul Kotarba, Lowell
Andrew John McArthur, Lowell
Louis Octave Mailhot, Lowell
Albert Joseph Masse, Lowell
Ernest Etienne Matton, Lawrence
Albert Dominique Narbonne, Lowell
Arthur Cyril Naylor, Methuen
Edmond Razza, Lawrence
Joseph Arthur Richard, Lowell
Leonard Slicer, N. Andover
Edward Richard Thibault, Lowell
Frederick Smith Whittaker, N. Andover

Diesel Engines—1 Year.

Russell Angis Beauchemin, Lowell
Alexander Belida, Graniteville
Guido Carlos Belli, Lowell
Leslie Walton Bellwood, Lowell
Philip Bibeault, Lowell
John Ernest Bourdelais, Lawrence
Raymond Irving Buchanan, Chelmsford
William Leo Burke, Lawrence
Joseph Albert Camden, Lowell
Rodolphe Joseph Coutu, Lowell
Roger Cedric Currier, Lowell
George Henry Dorval, Lowell
Philip Elias George, Lowell
Andrew Elzear Hamilton, N. Chelmsford
William Hughes, Lowell
Stanley Konieczny, Lowell
James Linatsas, Nashua, N. H.
William Garrett MacLean, Lowell
Bernard Alphonse Mullen, Lowell
William Joseph Murphy, Lowell
James Aloysius O'Gorman, Lawrence
Daniel Thomas O'Leary, Lawrence
Terence Patrick O'Rourke, Lowell
Peter Sechovich, Forge Village
Henry Frederic Silver, Lowell
Lawrence Talantzy, Graniteville
Robert Foster Wignall, Lowell
William James Winn, Lowell

Mathematics—2 Years.

Humphrey Joseph Coffey, Lowell
John Andrus Dean, W. Chelmsford
Lila Helen Downing, Lowell
Julia Myrtle Gentz, Lowell
Robert Mellor Green, Lowell
Walter Joseph Grondalski, Lowell
Betty John Kosartes, Lowell
Evenor Sophie Kosartes, Lowell
Mary Sophie Kosartes, Lowell
James Joseph McCartin, Lowell
Andrew James McDougall, Jr. Methuen
Peter Nicholas Mitsakos, Lowell
Christos Theodore Sarris, Lowell

Selling and Advertising—1 Year.

Don Albert Bakewell, Lowell
Kenneth Woodrow Brousseau, N. Andover
Angus Campbell, Lowell
Marguerite Mary Carland, Lowell
Joseph Francis Carney, Lowell
John Thomas Cleghorn, Chelmsford
James Bagshaw Coffey, Lowell
James Francis Cuerden, Lowell
Morris Davis, Lawrence
Theodore Efthymios Economou, Lowell
Elizabeth Rita Fenlon, Lowell
Paul Francis Gennell, Lowell
Alice Rita Hamill, Lowell
Harold Gilbert Heifetz, Lawrence
Alfred John Jodes, Lawrence
Walter Joseph Jurczak, Lawrence
Mary Kalemaras, Lowell
Henry Kaplan, Lawrence
Morris Kay, Lawrence
Edward George Krasnecky, N. Chelmsf'd
John George Kuzlotsky, Lawrence
David Lemkin, Lowell
James Russell McKeon, Lowell
Myrtle Elizabeth MacMillan, Lowell
Louis Francis Shadid Mansur, Lowell
Vincent Frank Miller, N. Andover
William Russell Moher, Nashua, N. H.
Andrew John Moynahan, Lowell
Anna Katharine Mullen, Lowell
Chester Howard Niles, Lowell
Donald Ernest Peaslee, Lowell
Lionel Alfred Pinet, Nashua, N. H.
Edwin John Riley, Lowell
Gerald Francis Riley, Lowell
George Francis Silva, Lowell
Edward Milton Simon, Lawrence
Stanley Szopa, Lowell
Peter William Tamulonis, Nashua, N.H.
Norman Harold Thrope, Lowell
John Raymond Trevors, Lowell
Alexander Vervaert, Lowell
Howard Daniel Weymouth, Lawrence

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1934-1938